PHENIX

PRPOSED DESIGN CHANGES FOR THE NORTH ARM MUON HIGH VOLTAGE DISTRIBUTION SYSTEM

This report shows the proposed design of the North Arm HV Distribution System. The design is based on the lessons learned in the design and implementation of the South Arm system.

Gregory W Hart

Los Alamos National Laboratory, P-25

31 July 2001

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cable data sheet

Technical details

For the South Arm chambers, we installed a plastic utility box near the chambers. A circuit card(s) with screw terminals and bleeder resistors was installed inside the box. The twisted wires from the chamber cards entered the box on one side through a conduit coupler. The HV inputs to the box are a bundle of red coaxial cables (RG-59) that enter the box through a larger conduit coupler on the adjacent side of the box.

We found that it was difficult to connect the wires and cables inside the box, and that access to the box would be limited. For the North arm, we plan to use a high voltage, multi-pin plug and socket interface at the chambers, and move the bleeders and terminals to a large chassis located near the power supplies.

We will replace the coaxial cables with multi-conductor high voltage, shielded cable.

For the South Arm, the end of the bundle of eight coax cables is soldered to a PCB mounted inside a small plastic box. This PCB contains a filter network. The opposite side of this box holds the mating AMP LHV Plug connector. These connectors plug into the HV Power Supply (HVPS). During installation we discovered that the density at the high voltage panel is very tight, making installation and strain relief difficult.

For the North Arm, we will move the filter network to a circuit card inside the rack-mounted chassis. We will use a multi-conductor high voltage cable from the chassis to the power supplies, which will decrease the front panel density and should improve the ability to strain relieve these connectors.

The High Voltage Multi-Pin connectors are made by AMP Inc., a subdivision of Tyco Electronics. They are rated at 2500 VDC. These connectors are referred to as “M Series Special Applications Connectors”. They are used by CAEN, a high voltage power supply manufacturer, in their model 1526 High Voltage board. These connectors are also used in the LeCroy Model 1440 High Voltage Power Supply.

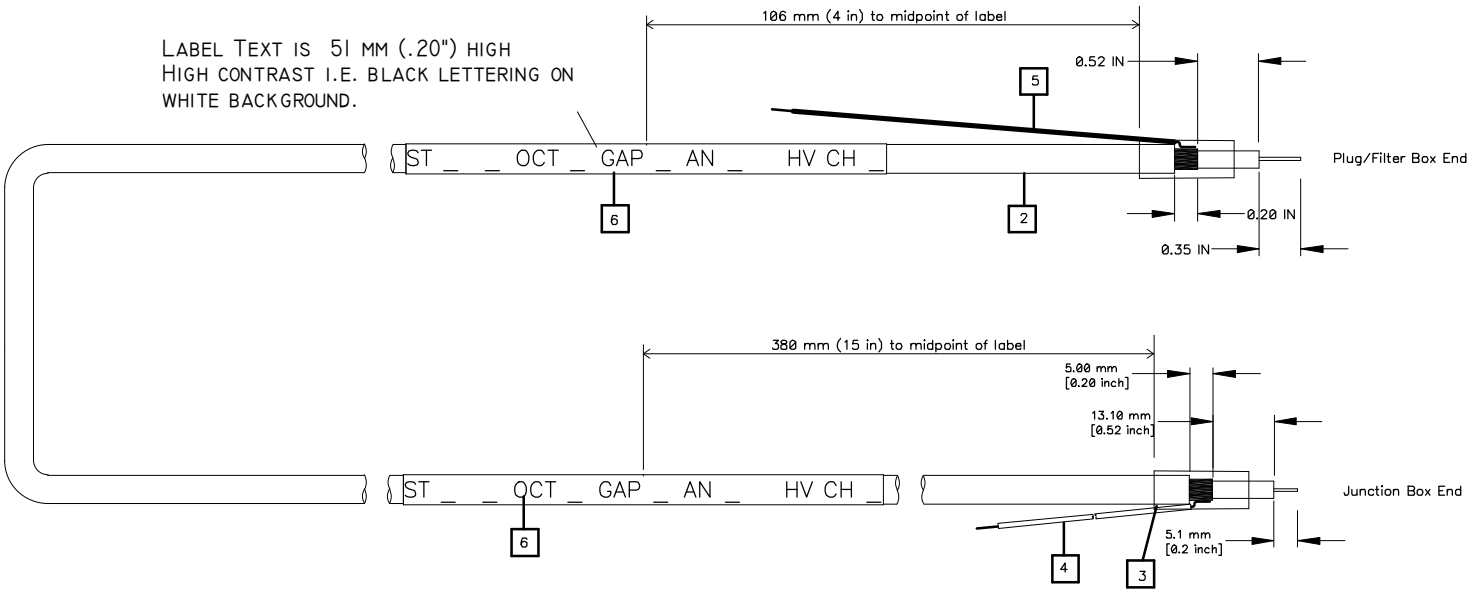
I have tested these connectors, with pins in adjacent holes for 7 days at 5,000 volts DC with no detectable leakage current.

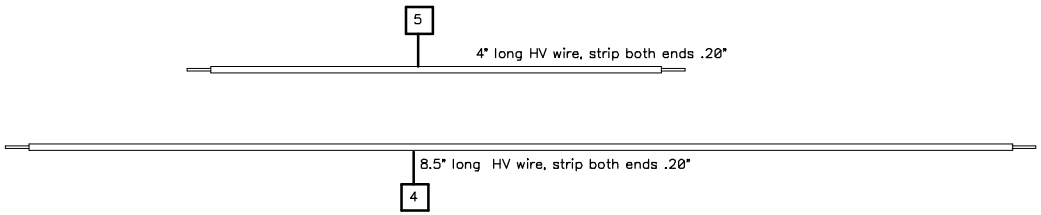
The HV Distribution Box will be installed in the racks next to the HV Power Supplies on the elevated platform. A plug-in HV Distribution/filter circuit PCB has been designed for 16 channels. These cards are designed to operate with adjacent channels at 3,500 volts, in the event a wire breaks in the chambers.

The 11 wire multi-conductor, high voltage shielded cable is based on the 19 wire cable is used a Jefferson Labs. The wires within the shield are Teflon insulated, with a rating of 10 KV DC. The outer jacket is red in color, and rated for plenum use, UL Subjects 13, 910 and 1581.

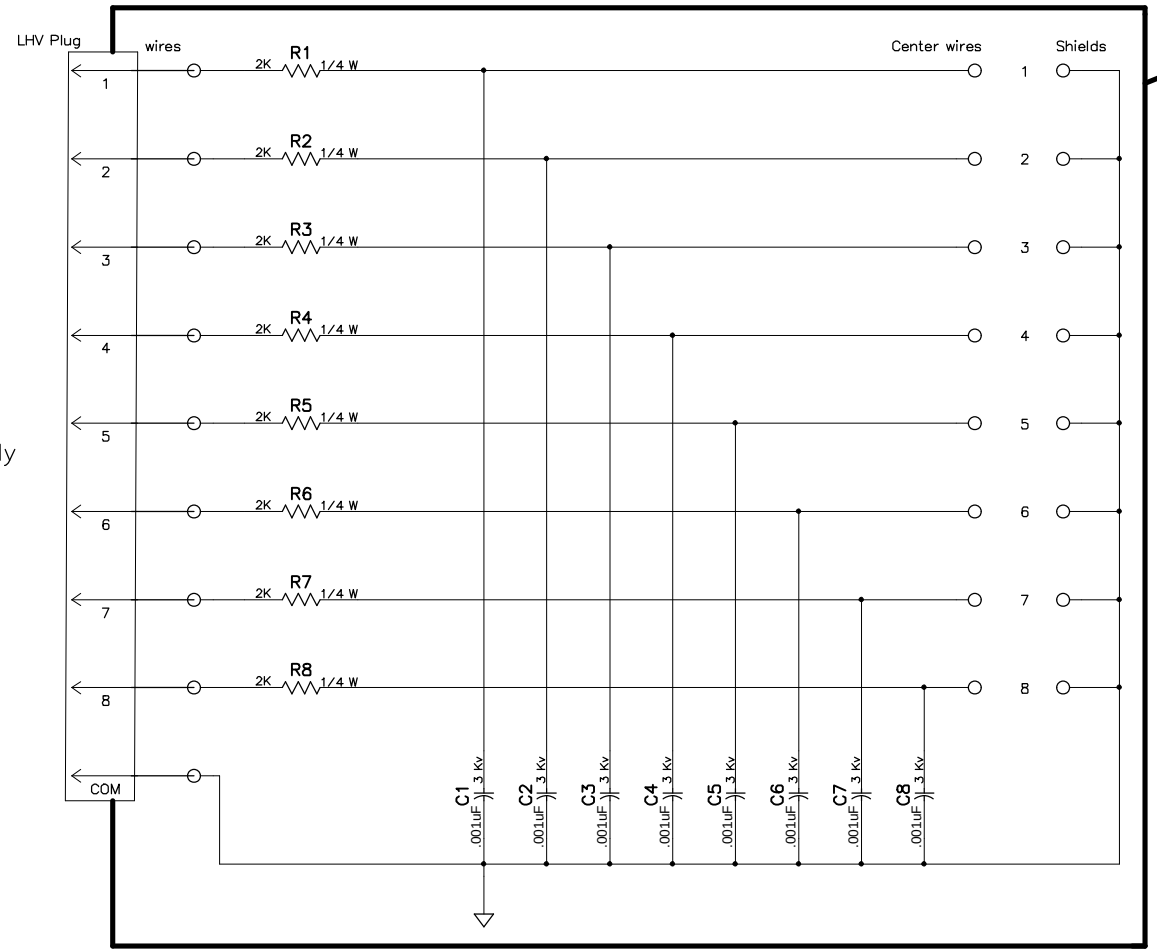
Item	Qty	Manufacturer	Description	Part #	Source	Cat #
1	1		assembly Drawing	63Y299054	P-25 LANL	
2	*	Coleman/CCI	Coax Cable, Red, 2300 v rms, 75 ohm	RG59 B/U	BNL Stock	A-30304
3	2	Alpha Wire	Soldering Sleeve, 105 deg C	FIT-SLV-16	Summit	
4	8.5"	Judd Wire	Wire, 24 AWG, 7/32 Str., 5 kV, Red	V0505003	Summit	
5	4"	Judd Wire	Wire, 24 AWG, 7/32 Str., 5 kV, Red	V0505003	Summit	
6	2		see spreadsheet "63Y299054 Labels & Lengths"			

Alpha, Braid Shield Grounding System, FIT-SLV Soldering Sleeves
Use Alpha FIT GUN-2 with GA-3 reflector or Alpha FIT GUN-1R1 with GA-2 relector
Heating time is 3 to 5 seconds.
Heat should be maintained on sleeve until solder ring changes from dull grey to bright silver and flows toward dam on both ends of sleeve.





Los Alamos National Laboratory		
Title	PHENIX MUTR HV DISTRIBUTION SYSTEM	
ASSEMBLY DRAWING HV COAX CABLE		
Size B	Date Originated: 7 Apr 2000	
	Date Last Revised: 23 June 2000	
LANL DWG # 63Y299054		Approved By: Sondheim
PHENIX DWG #105-0312-0212		Drawn by: G. Hart
Filename 299054.pcb		Sheet of 1



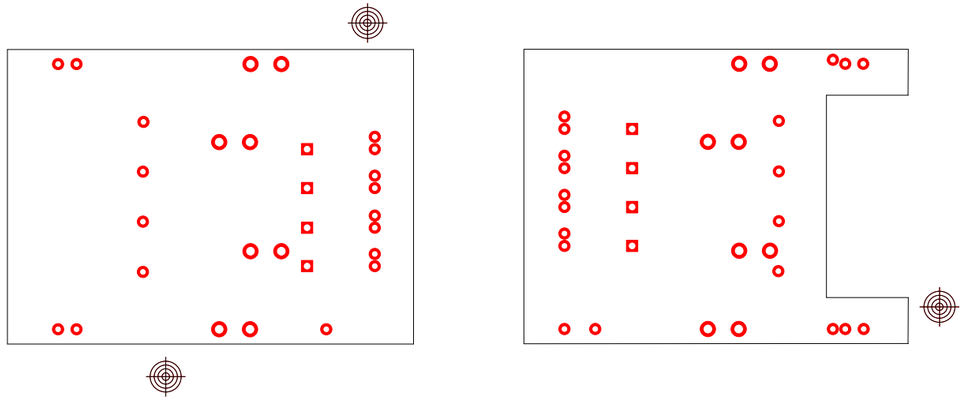
Enclosed in an insulating box

To LeCroy
Power Supply
Output

From High Voltage
Dist. Box.
(RG–59 Coaxial Cables)

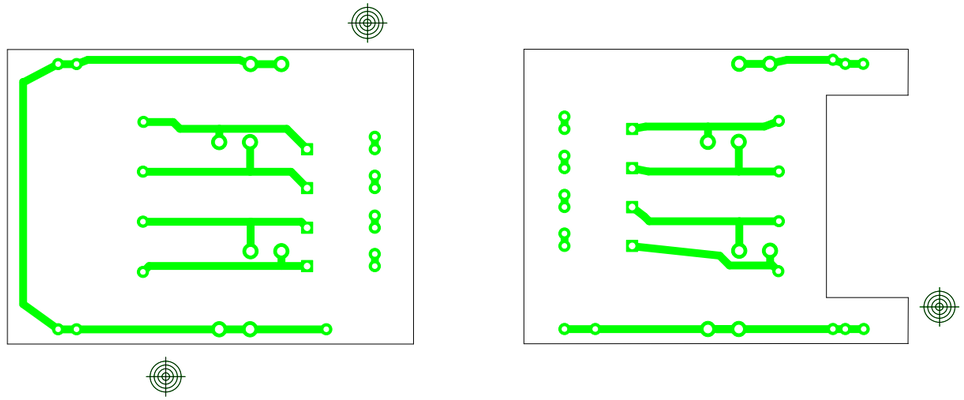
Cables solder directly to PCB

Los Alamos National Laboratory		
Title: LeCroy HV Plug/Filter box, 8 Channel		
SCHEMATIC		
Size	Date Originated: 23 Feb 2000	
	Last Revised: 5 Apr 2000	
LANL DWG #: 63Y299053		Approved By:W. Sondheim
PHENIX #: 105–0312–210		Drawn by: G. Hart
Filename: 299053RC.sch		Sheet of



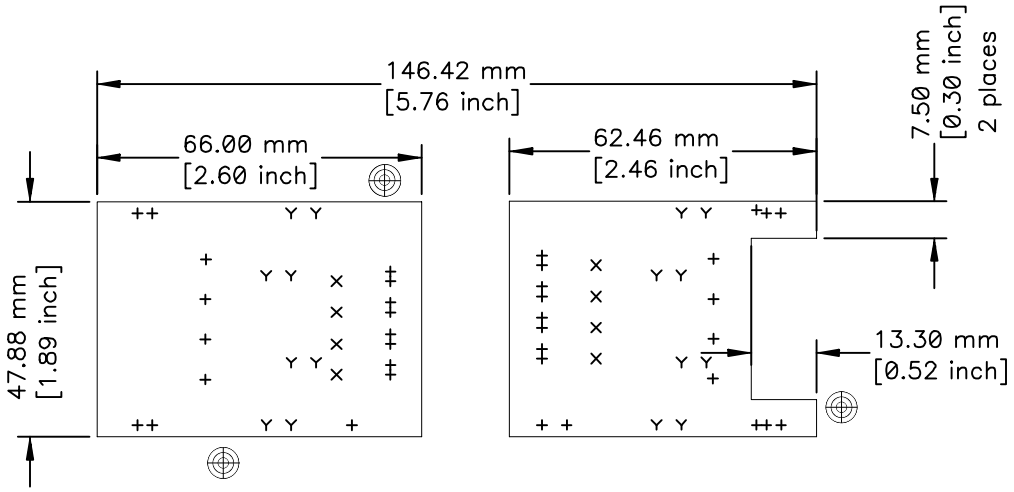
Layer 1 (TOP)

Los Alamos National Laboratory		
Title	PHENIX MuTr HV Distribution System	
LeCroy HV Plug/Filter box, 8 channel		
Size B	Date Originated: 30 APR 1998	
	Date Last Revised: 21 Apr 2000	
LANL DWG # 63Y299053A		Approved By: W. Sondheim
PHENIX DWG #: 105-0312-210		Drawn by: G. Hart
Filename 299053a.pcb		Sheet 1 of 8



Layer 2 (Bottom)

Los Alamos National Laboratory		
Title	PHENIX MuTr HV Distribution System	
LeCroy HV Plug/Filter box, 8 channel		
Size B	Date Originated: 30 APR 1998	
	Date Last Revised: 21 Apr 2000	
LANL DWG # 63Y299053A		Approved By: W. Sondheim
PHENIX DWG #: 105-0312-210		Drawn by: G. Hart
Filename 299053a.pcb		Sheet 2 of 8

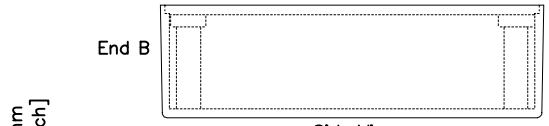


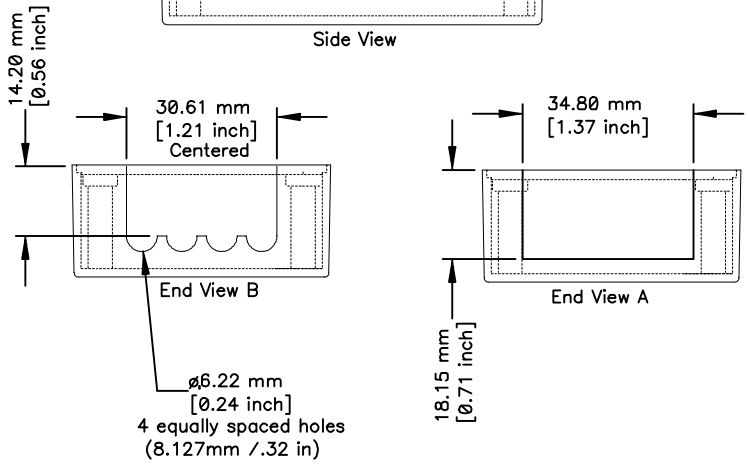
Cut into two separate cards

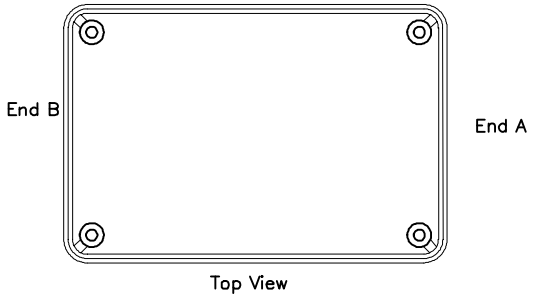
Drill Symbol Table		
Hole Dia (mm)	Symbol	Quantity
0.81	+	37
0.96	X	8
1.29	Y	16

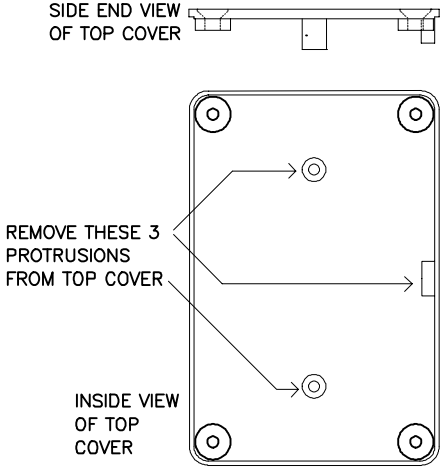
1. Board material to be FR4
2. Final board thickness to be .093" (2.36mm)
3. Tin Lead finish
4. All holes plated thru
5. All tolerances to be +/− .005" (.127mm) unless otherwise stated.
6. Use non−conductive ink for manufacturer legends, date codes, etc. Do not add any copper lettering/symbols to any layer.
7. Standard commercial solder mask & silscreen
8. NC Drill data:
units=inches
ASCII none
Leading Zero Supression
9. Fabricate to IPC 4101

Los Alamos National Laboratory		
Title	PHENIX MuTr HV Distribution System	
	LeCroy HV Plug/Filter box, 8 channel	
Size B	Date Originated: 30 APR 1998	
	Date Last Revised: 9 Apr 2000	
LANL DWG # 63Y299053A		Approved By: W. Sondheim
PHENIX DWG #: 105−0312−210		Drawn by: G. Hart
Filename 299053a.pcb		Sheet 5 of 8





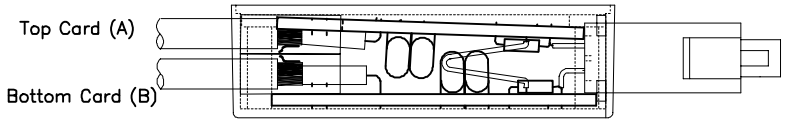




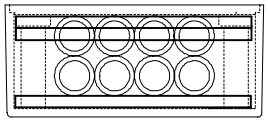
Box Fabrication Drawing

Los Alamos National Laboratory		
Title	PHENIX MuTr HV Distribution System	
LeCroy HV Plug/Filter box, 8 channel		
Size B	Date Originated: 30 APR 1998	
	Date Last Revised: 9 Apr 2000	
LANL DWG # 63Y299053A		Approved By: W. Sondheim
PHENIX DWG #: 105-0312-210		Drawn by: G. Hart
Filename 299053a.pcb		Sheet 6 of 8

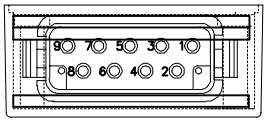
Item	Ref Des	Qty	Manufacturer	Description	Part #	Source	Cat #
1	R1–8	8	Multicomp	Resistor, Carbon Comp, 2 K, 1/4 W	RC1/4G202JT	Newark	10N395
2	C1–8	8	Sprague/Vishay	Capacitor, .001 uF @ 3 kv	30GAD10	Newark	46F5277
3	P1	1	AMP	LHV 8 channel plug	443161–1	BNL	
4		1	Bud	Box, Plastic, UL 94V–0, Black, w/lid	CU–789	Newark	51F3477
5	JP1, 2, OUTS	13"	Judd Wire	Wire, 24 AWG, 7/32 Str., 5 kV, Red	V0505003	Summit	
6		1		PCB, single sided, .062" thick, FR–4	63Y299053A/B		
7		1		assembly	63Y299053		



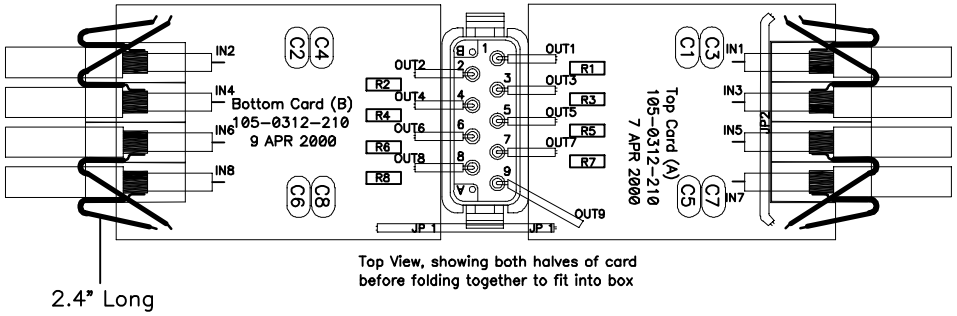
Side View, showing both cards installed in box



Cable end view

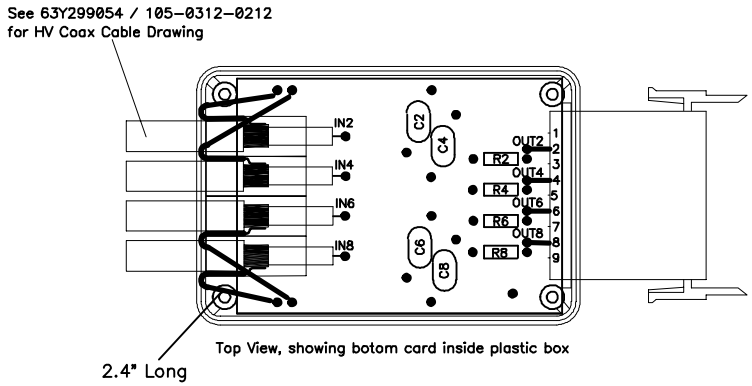


Plug end view



Top View, showing both halves of card before folding together to fit into box

2.4" Long

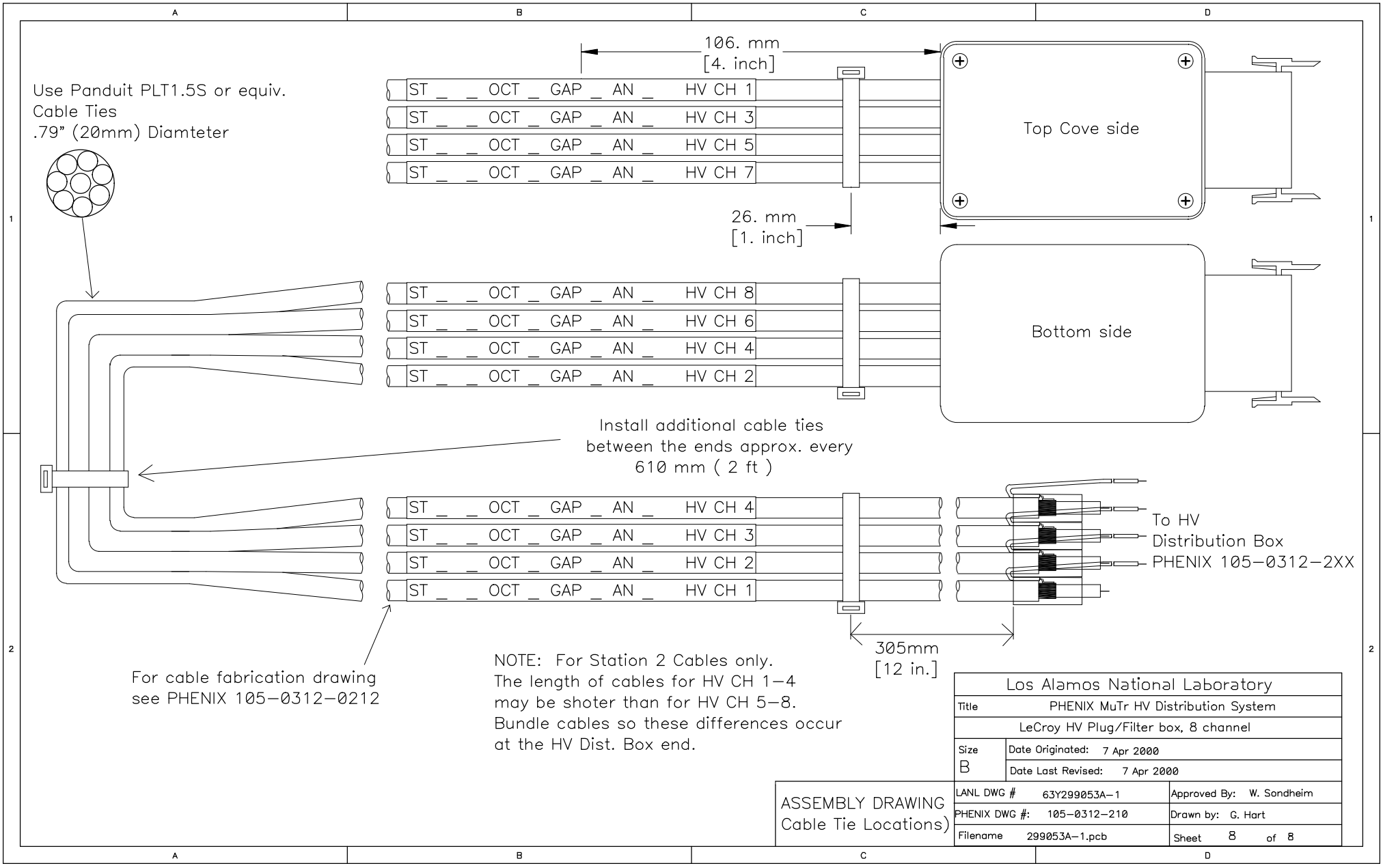


Top View, showing botom card inside plastic box

1. Assemble and Solder per IPC–6012, Class II
2. Apply acrylic conformal coating (1 mil minimum thickness) to both sides of assembled boards

ASSEMBLY DRAWING

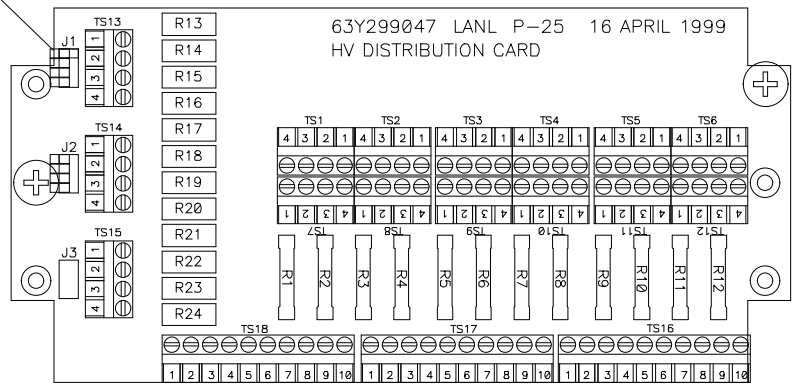
Los Alamos National Laboratory		
Title	PHENIX MuTr HV Distribution System	
LeCroy HV Plug/Filter box, 8 channel		
Size B	Date Originated: 30 APR 1998	
	Date Last Revised: 9 Apr 2000	
LANL DWG # 63Y299053A		Approved By: W. Sondheim
PHENIX DWG #: 105–0312–210		Drawn by: G. Hart
Filename 299053a.pcb		Sheet 7 of 8



Los Alamos National Laboratory		
Title	PHENIX MuTr HV Distribution System	
LeCroy HV Plug/Filter box, 8 channel		
Size B	Date Originated: 7 Apr 2000	
	Date Last Revised: 7 Apr 2000	
ASSEMBLY DRAWING Cable Tie Locations)	LANL DWG # 63Y299053A-1	Approved By: W. Sondheim
	PHENIX DWG #: 105-0312-210	Drawn by: G. Hart
	Filename 299053A-1.pcb	Sheet 8 of 8

ITEM REF #	QTY	MANUFACTURER	DESCRIPTION	PART #	Source	Cat #	Cost/ea
	1	Weidmuller–Klippon	Box, Polyester, UL94V–0, Black	951024	Newark/Farnell	561–599	38.00
TS16– TS18	3	Weidmuller–Klippon	Terminal Block, 45 deg Clamp, 10 position	3026–6	Newark	90F9176	1.03
TS1–6, TS13–15	9	Weidmuller–Klippon	Terminal Block, 45 deg Clamp, 4 position	3077–6	Newark	90F9175	1.03
R13–24	12	Multicomp	Resistor, Carbon Comp., 1W 1K ohm, +/–10% tol, 500V	RC100G4R7KB	Newark	92N3521	.72
R1–12	12	Victoreen	Resistor, 250 Gohms, Epoxy Coated, 5Kv, 1 W, 10% tol	MOX–750–23 250,000 Meg 10%	Harrison		4.11
J1–3	3	BERG	Header, Vertical, Double Row, Gold Plated, 8 pins	67996–272	Newark	89F6219	.32
	12	BERG	Jumper socket, gold plated, open top, Blue	65474–001	Newark	94F7344	.35
	1		PCB	63Y 299047			

Place shorting plugs on J1– J3 on left pins only



PC Card Assembly Notes

.

1 .Assemble and solder per IPC –6012 Class II

.

2. Apply acrylic conformal coating on all exposed solder joints on bottom side of card and on R1–R12 on top side

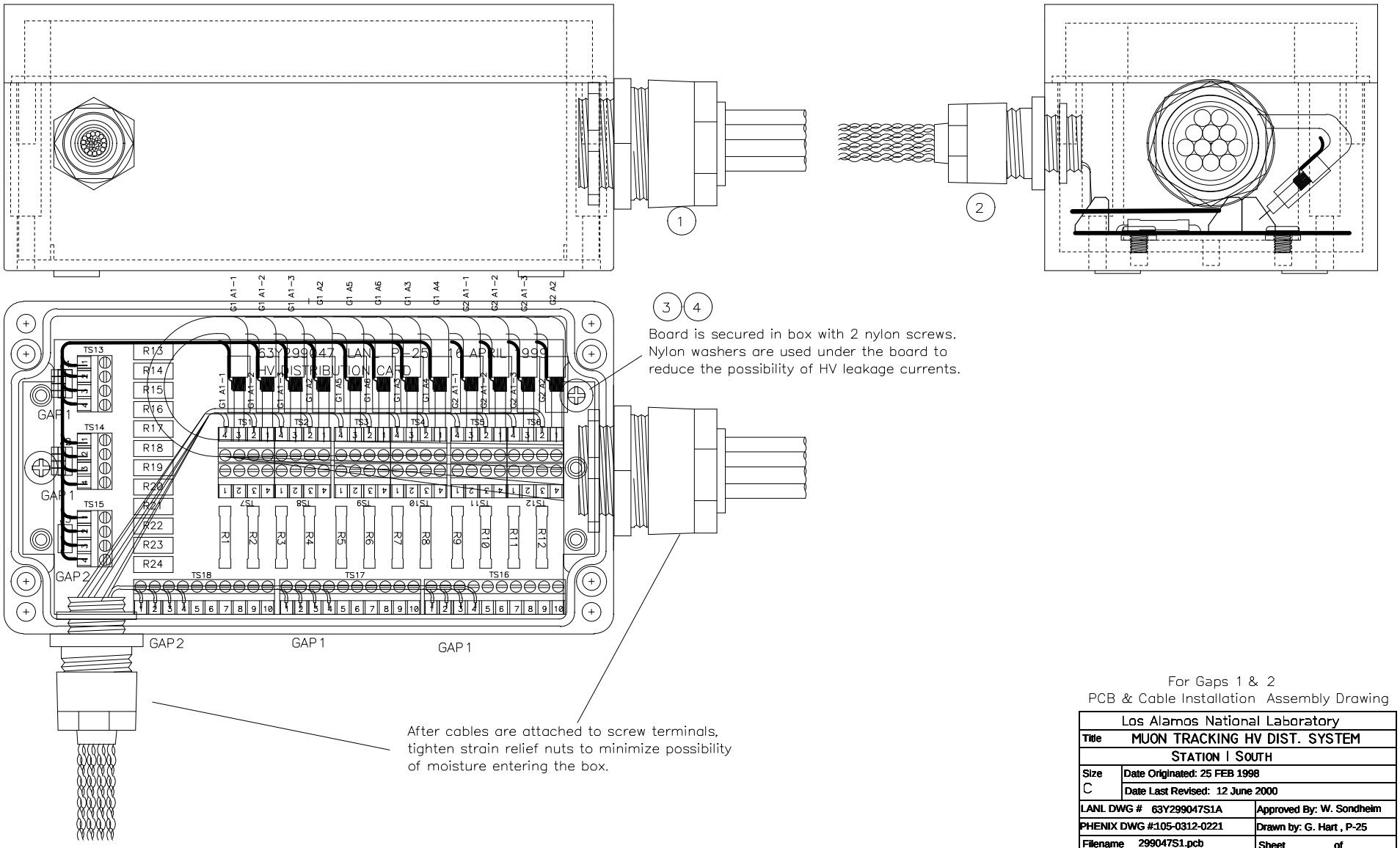
.

3. Do not install TS7 thru TS12

Board Assembly Drawing

Los Alamos National Laboratory	
Title	MUON TRACKING HV DIST. SYSTEM
	STATION I SOUTH
Size C	Date Originated: 25 FEB 1998
	Date Last Revised: 12 June 2000
LANL DWG # 63Y299047S1A	Approved By: W. Sondheim
PHENIX DWG #105-0312-0221	Drawn by: G. Hart , P-25
Filename 299047S1.pcb	Sheet of

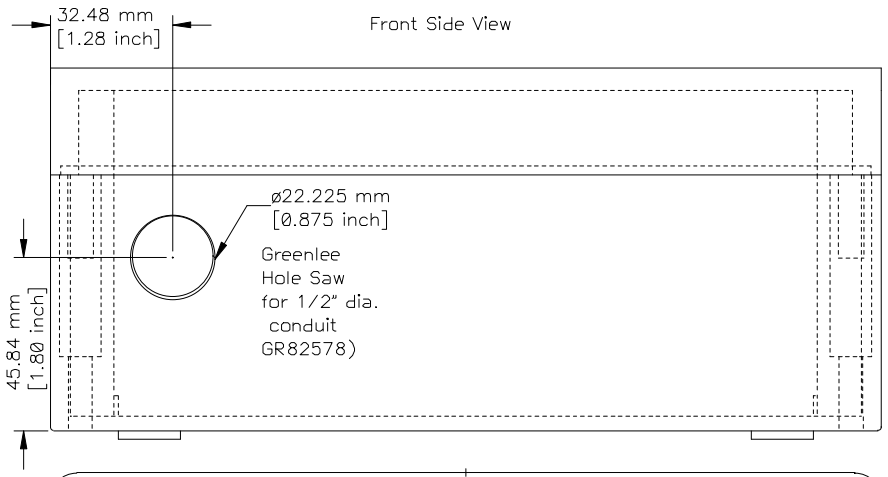
ITEM REF #	QTY	MANUFACTURER	DESCRIPTION	PART #	Source	Cat #	Cost/ea
1	1	O-Z/ Gedney	Connector, Strain Releif, Grip Tite Type SR	SR-100-1000	Summit Electric	OZSR1001000	3.66
2	1	O-Z/ Gedney	Connector, Strain Releif, Grip Tite Type SR	SR-50-375	Summit Electric	OZSR50375	2.31
3	2	Micro Plastics, inc	Screw, Phillips head, M6 x 8, 1 mm pitch, Plastic	50M060100N008	Barnhill Bolt	1941-M6-M8-7A00	.35
4	2	Micro Plastics, inc	Washer, M6, plastic	16M06012150	Barnhill Bolt	1926-M6-A-7	.39

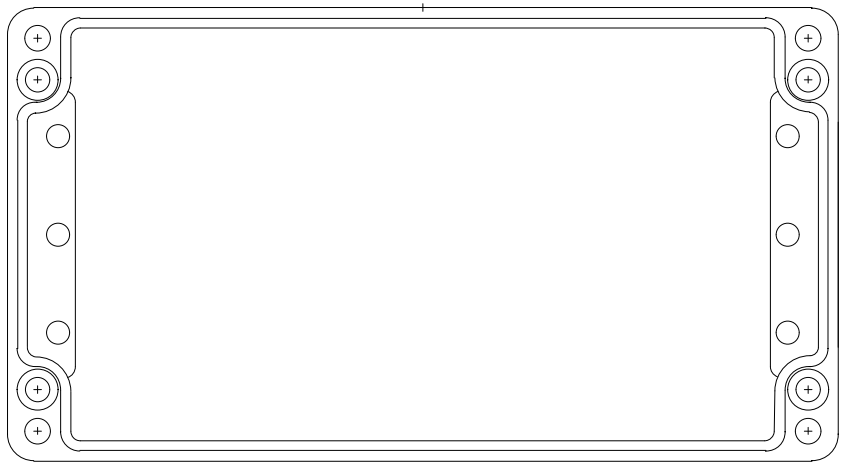


For Gaps 1 & 2
PCB & Cable Installation Assembly Drawing

Los Alamos National Laboratory		
Title	MUON TRACKING HV DIST. SYSTEM	
	STATION I SOUTH	
Size C	Date Originated: 25 FEB 1998	
	Date Last Revised: 12 June 2000	
LANL DWG # 63Y299047S1A		Approved By: W. Sondheim
PHENIX DWG #:105-0312-0221		Drawn by: G. Hart , P-25
Filename 299047S1.pcb		Sheet of

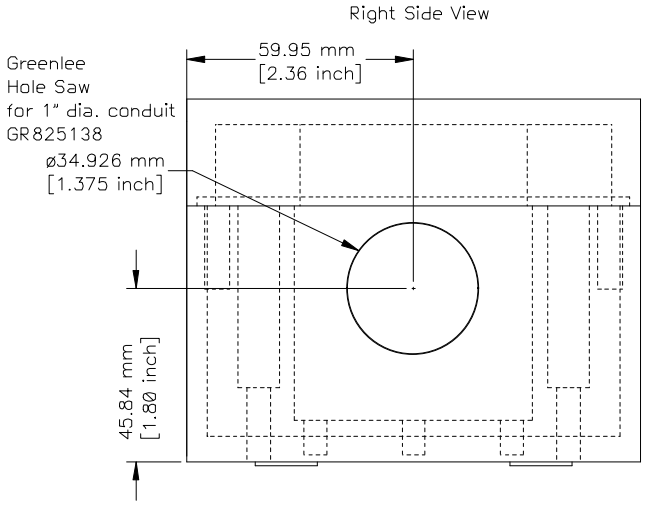
Box shown with lid installed





Top View

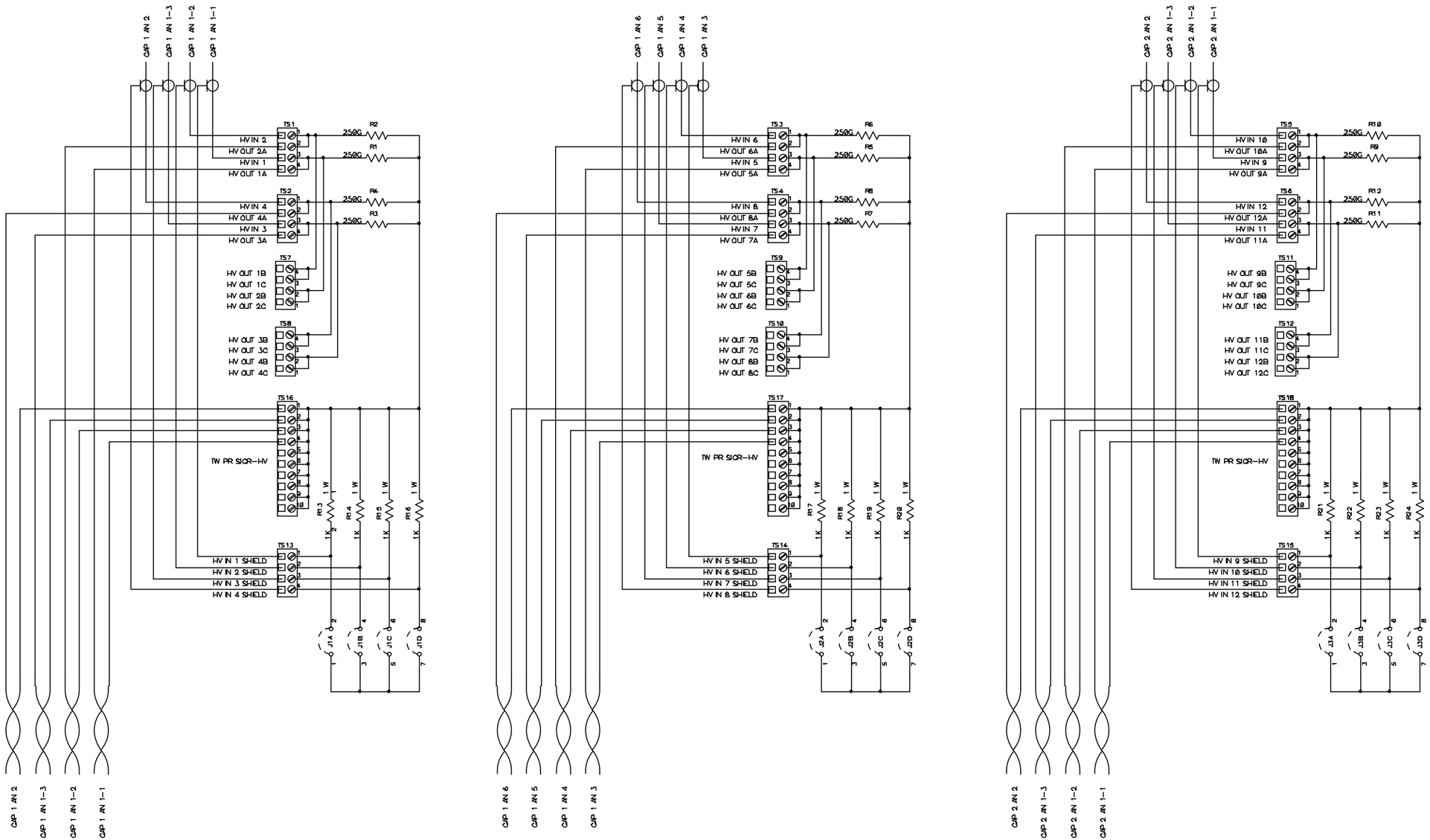
Right Side View



Box Fabrication Drawing

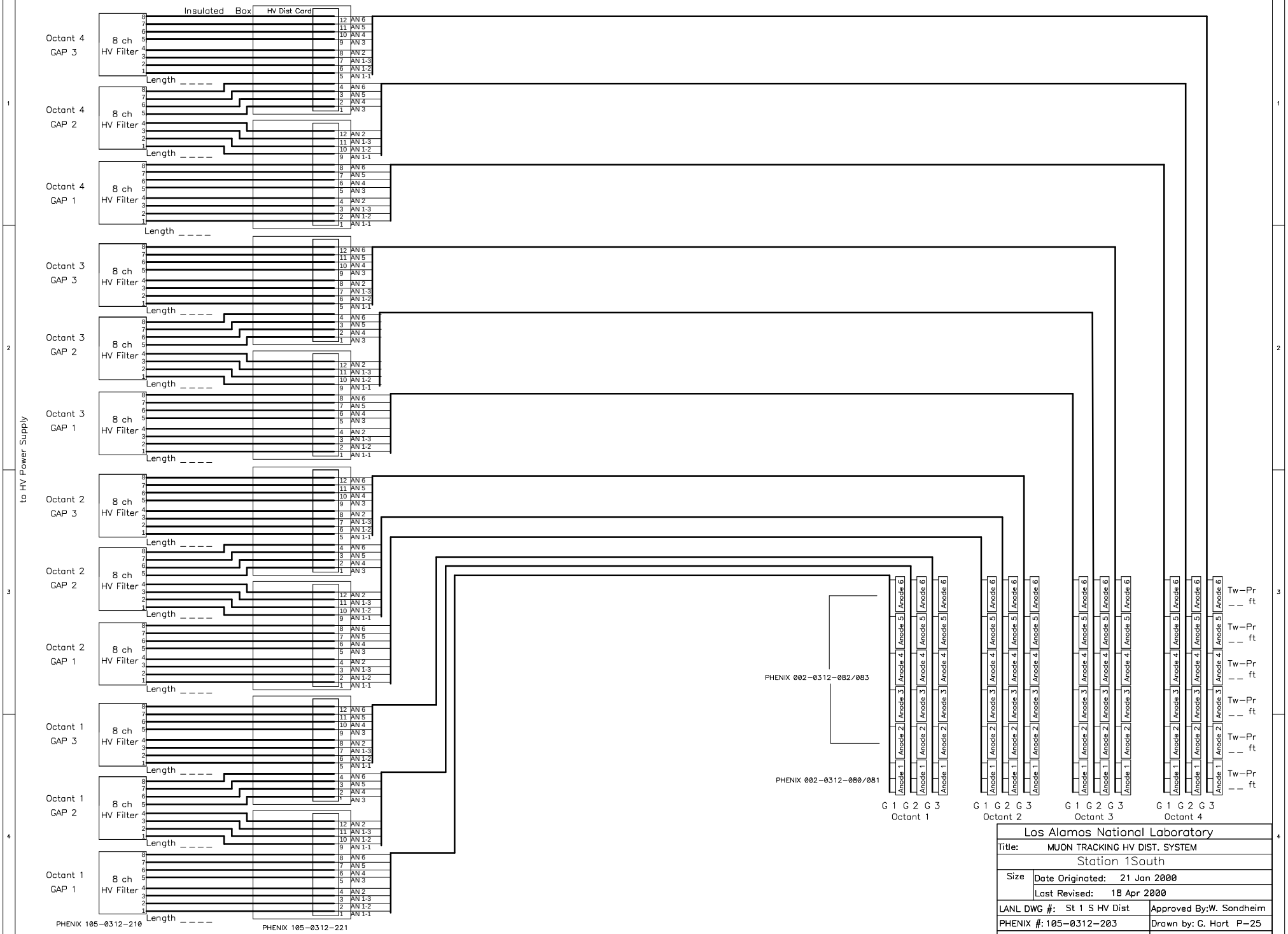
Los Alamos National Laboratory		
Title	MUON TRACKING HV DIST. SYSTEM	
	STATION 2 SOUTH	
Size C	Date Originated: 25 FEB 1998	
	Date Last Revised: 26 June 2000	
LANL DWG # 63Y299047S3		Approved By: W. Sondheim
PHENIX DWG #105-0312-0223		Drawn by: G. Hart , P-25
Filename 299047S2.pcb		Sheet of

RG59/U Coax cables to HV Power Supply



Twisted pairs from Chamber Anode cards

Los Alamos National Laboratory		
Title: MUON TRACKING HV DIST BOX 1 South		
SCHEMATIC OCTANT 1 GAPs 1–2		
Size C	Date Originated: 14 April 1999	
	Last Revised: 16 Nov 2000	
LANL DWG #: 63Y299047A		Approved By:W. Sondheim
PHENIX #: 105–0312–221		Drawn by: G. Hart , P–25
Filename: ST 1 S HV DIST BOX.sch		Sheet 1 of 16



Los Alamos National Laboratory	
Title: MUON TRACKING HV DIST. SYSTEM	
Station 1South	
Size	Date Originated: 21 Jan 2000
	Last Revised: 18 Apr 2000
LANL DWG #: St 1 S HV Dist	Approved By:W. Sondheim
PHENIX #: 105-0312-203	Drawn by: G. Hart P-25
Filename: St 1 S HV Dist.sch	Sheet 1 of 2

South Arm HVDS Components

Wire / Cable

Technical data sheet RG 59/U Coax
http://www.colemancable.com/catalog/92004.pdf
Technical data sheet Belden, 83003 wire
http://ecom.belden.com/static/ZZBLDNTD01FROMCATA.HTM?P0=83003
Technical data sheet Judd, 5KV wire
http://www.juddwire.com/jwelcome.nsf/flexrad_hv.htm

Hardware

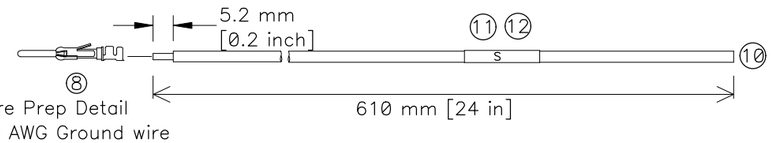
Drawing of Data of Weidmuller enclosure
http://catalog.weidmuller.com/asp/datasheet.asp?PN=951024&FAM=Boxes
Drawing & Data of MK Term Blocks
http://www.newark.com/product-details/text/cd119/5249.html
Drawing & Data of Bud plastic box
http://www.budind.com/pdf/hb789.pdf

Electronic Components

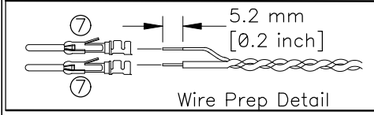
Drawing & Data of 30GAD10 Capacitor
http://www.newark.com/product-details/text/cd119/7173.html
Drawing & Data of 1 Watt Resistors
http://www.newark.com/product-details/datasheet/spc/ta-84.pdf
Drawing & Data of MOX HV Resistors
http://www.ohmite.com/catalog/pdf/v_minimox.pdf

ITEM	QTY	MANUFACTURER	DESCRIPTION	PART #	Source	Cat #	Cost/ea
1	1	AMP (Div of Tyco)	Block Connector, 20 Pin, HV rated, Male	203908-2	Newark Electronics		12.00
2	1	AMP (Div of Tyco)	Pin Hood, Internal, for item 1	202434-4	Newark Electronics		6.00
3	2	AMP (Div of Tyco)	Guide Pin, for Type M Connectors (Includes washer & nut)	200833-2	Newark Electronics	50F656	1.00
4	2	AMP (Div of Tyco)	Guide Socket, for Type M Connectors (Includes washer & nut)	200835-2	Newark Electronics	50F657	1.43
5	2	AMP (Div of Tyco)	Jackscrew Kit, Male, Fixed	200874-1	Newark Electronics	50F661	1.17
6	1	AMP (Div of Tyco)	Strain Relief, Short, For item 1	201224-1	Digi-Key	201224-1-ND	7.08
7	17	AMP (Div of Tyco)	Pin, Type III, for 20-24 AWG Wire	66103-1	Newark Electronics	50F575	.60
8	3	AMP (Div of Tyco)	Pin, Type III, for 16-18 AWG Wire	66099-1	Newark Electronics	50F676	.60
9	2	Belden	Hook-up Wire, 22 AWG, Teflon, Green, 38mm (1.5 in) long	83026-100-5	Newark Electronics	02F5834	.03
10	2	Belden	Hook-up Wire, 16 AWG, Teflon, Green, 610mm (24 in) long	83030-100-5	Newark Electronics	02F5420	.88
11	.5"	Panduit	Wire Label, G, supplied on 96" roll	PMDR-G	Newark Electronics	87F4587	.12
12	.5"	Panduit	Wire Label, S, supplied on 96" roll	PMDR-S	Newark Electronics	87F4587	.12

Apply a label in the middle of each pigtail
Pin 19 Label is letter "G" to denote Grounds
Pin 20 Label is letter "S" to denote HV Cable Shield

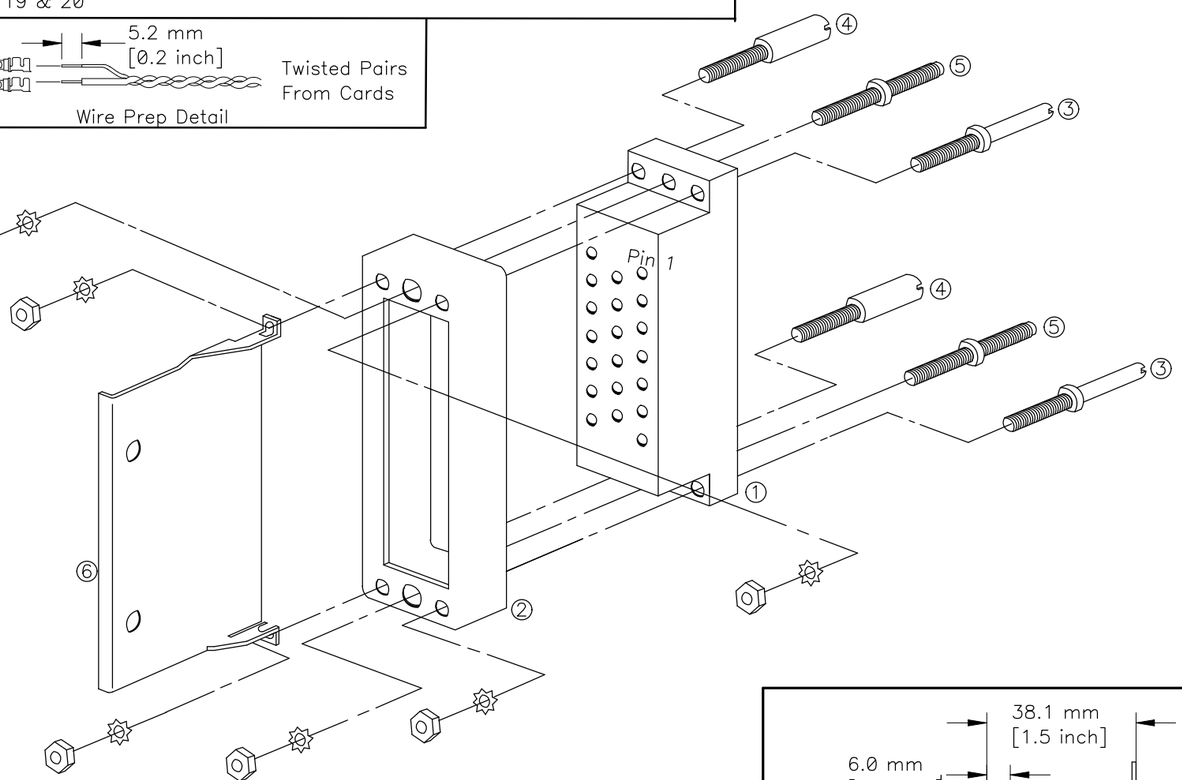


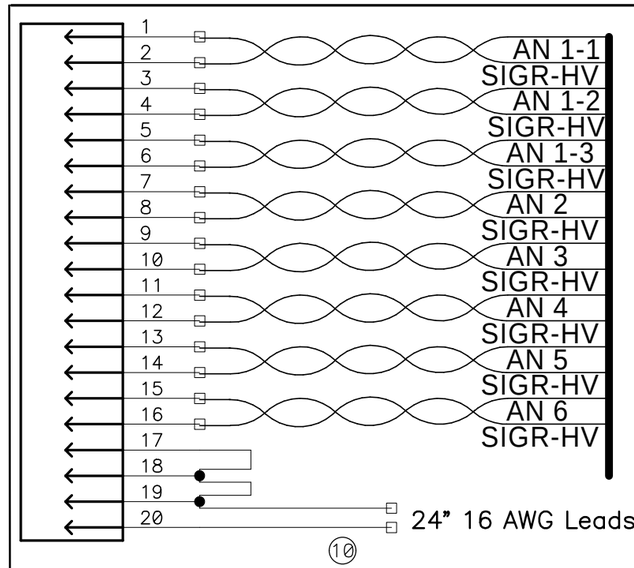
Wire Prep Detail
16 AWG Ground wire
for Pins 19 & 20



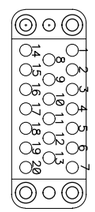
Wire Prep Detail

Twisted Pairs
From Cards

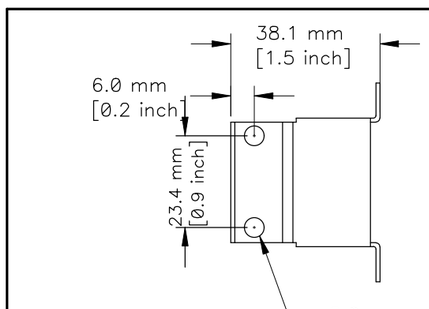




SCHEMATIC of connector wiring



REAR View of 203908-2
Block Connector
(Pins inserted from this end)

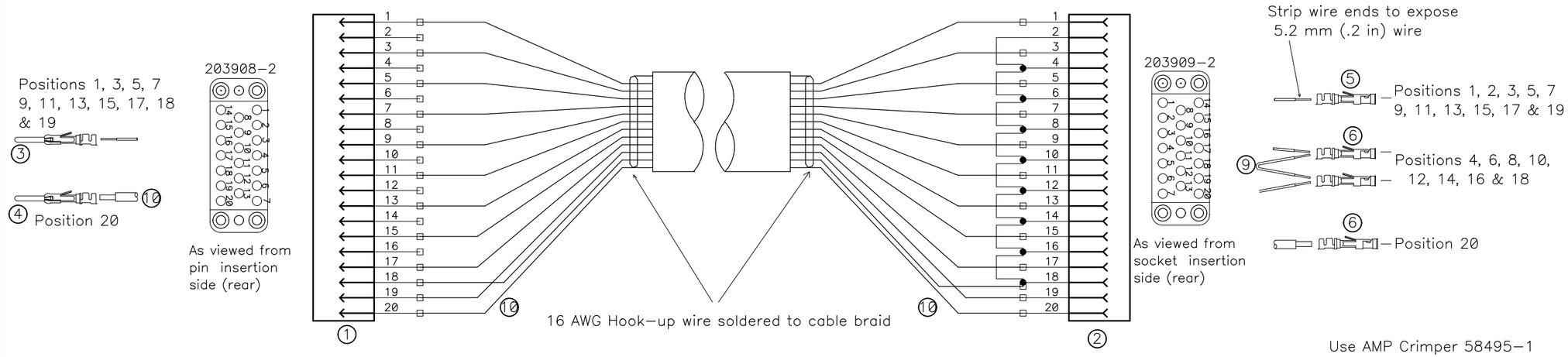


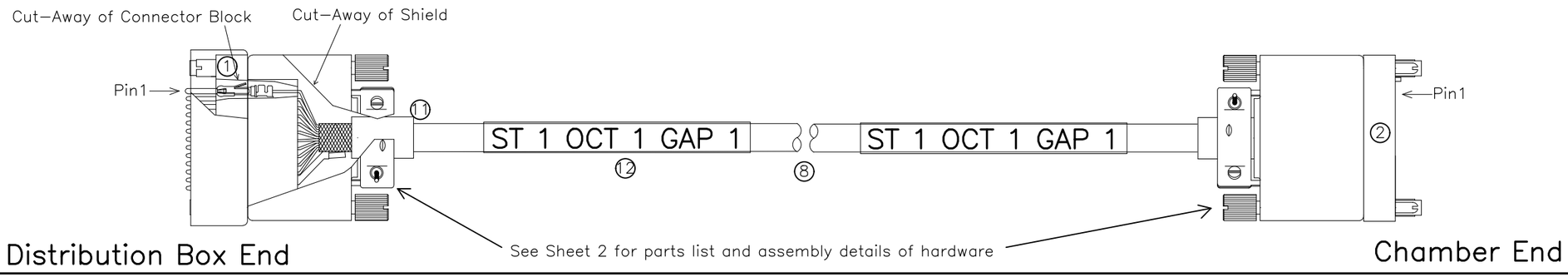
Holes redrilled
from 4.7 mm to 5.0 mm

Assembly Detail

Los Alamos National Laboratory		
Title	MUON TRACKING HV DIST. SYSTEM	
St 1 North Chamber HV Connector		
Size C	Date Originated: 31 May 2001	
	Date Last Revised: 24 July 2001	
LANL DWG # 135Y299083		Approved By: W. Sondheim
PHENIX DWG #: 002-0312-226		Drawn by: G. Hart
Filename 135Y299083 CH 1.pcb		Sheet 1 of 1

ITEM	QTY	MANUFACTURER	DESCRIPTION	PART #	Source	Cat #	Cost/ea
1	1	AMP (Div of Tyco)	Block Connector, 20 Pin, HV rated, Male	203908–2	Newark Electronics		12.00
2	1	AMP (Div of Tyco)	Block Connector, 20 Pin, HV rated, Female	203909–2	Newark Electronics		12.00
3	11	AMP (Div of Tyco)	Pin, Type III, for 20–24 AWG Wire	66103–1	Newark Electronics	50F575	.60
4	1	AMP (Div of Tyco)	Pin, Type III, for 16–18 AWG Wire	66099–1	Newark Electronics	50F676	.60
5	11	AMP (Div of Tyco)	Socket, Type III, for 20–24 AWG Wire	66105–1	Newark Electronics	50F576	.80
6	9	AMP (Div of Tyco)	Socket, Type III, for 16–18 AWG Wire	66101–1	Newark Electronics	50F573	.80
8	1	General Wire Prod.	Custom 11 Cond. Shielded HV Cable	001–21919 Rev B	Newark Electronics		.45/ft
9	9	Belden	Hook–up Wire, 22 AWG, Treflon, Green, 31mm (1.2 in) long	83026–100–5	Newark Electronics	02F5834	.02
10	2	Belden	Hook–up Wire, 16 AWG, Teflon, Green, 25.4 mm (1 in) long	83030–100–5	Newark Electronics	02F5420	.04
11	2	Nalgene	PVC Tubing, Clear, 19mm (3/4") long, 3/8" ID, 1/2" OD	8000–0120	Fischer Scientific	14–176–36	.02
12	2		Cable Label, see sheet 3 for text				





Connector Position	Color of HV Cable Wires
1	Brown
3	Red
5	Orange
7	Yellow
9	Green
11	Blue
13	Violet
15	Gray
17	Black
18	White
19	White & Blue

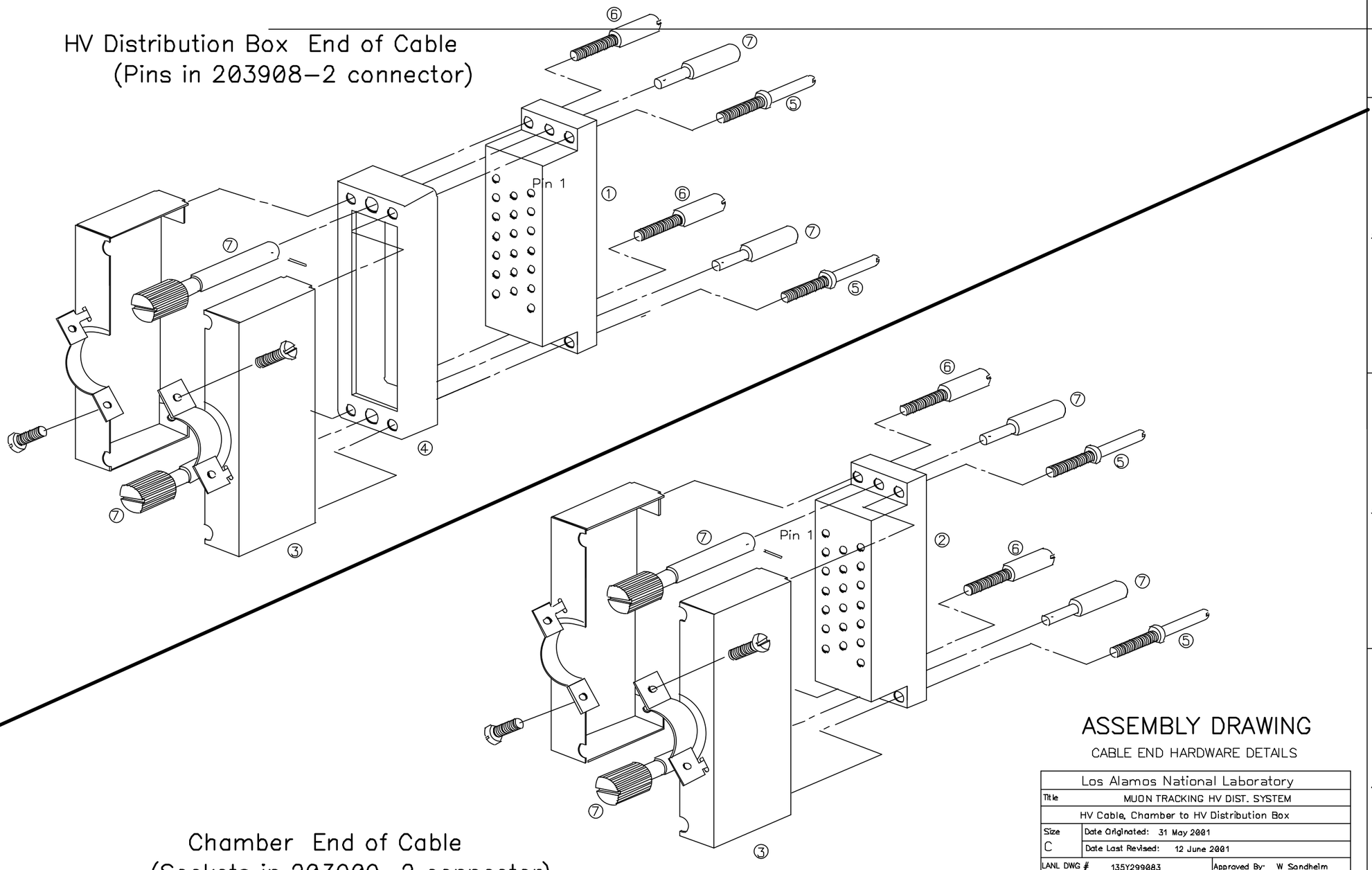
ASSEMBLY DRAWING

SCHEMATIC & CABLE WIRING DETAILS

Los Alamos National Laboratory		
Title	MUON TRACKING HV DIST. SYSTEM	
HV Cable, Chamber to HV Distribution Box		
Size C	Date Originated: 31 May 2001	
	Date Last Revised: 23 July 2001	
LANL DWG # 135Y299083		Approved By: W. Sondheim
PHENIX DWG #: 002–0312–226		Drawn by: G. Hart
Filename 135Y299083 CH–DB–1.pcb		Sheet 1 of 3

ITEM	QTY	MANUFACTURER	DESCRIPTION	PART #	Source	Cat #	Cost/ea
1	1	AMP (Div of Tyco)	Block Connector, 20 Pin, HV rated, Male	203908-2	See SHEET 1		
2	1	AMP (Div of Tyco)	Block Connector, 20 Pin, HV rated, Female	203909-2	See SHEET 1		
3	2	AMP (Div of Tyco)	Shield Kit, Short, M-Series, Two-Piece, with screws & clamps	200517-2	Digi-Key	200517-2-ND	11.00
4	1	AMP (Div of Tyco)	Pin Hood, Internal, M-Seris	202434-4	Newark Electronics		7.00
5	4	AMP (Div of Tyco)	Guide Pin, for Type M Connectors	200833-2	Newark Electronics	50F656	1.00
6	4	AMP (Div of Tyco)	Guide Socket, for Type M Connectors	200835-2	Newark Electronics	50F657	1.43
7	4	AMP (Div of Tyco)	Jackscrew Kit, Female, For type M connector	200867-1	Newark Electronics	50F659	2.62

HV Distribution Box End of Cable
(Pins in 203908-2 connector)



Chamber End of Cable
(Sockets in 203909-2 connector)

ASSEMBLY DRAWING

CABLE END HARDWARE DETAILS

Los Alamos National Laboratory		
Title	MUON TRACKING HV DIST. SYSTEM	
HV Cable, Chamber to HV Distribution Box		
Size C	Date Originated: 31 May 2001	
	Date Last Revised: 12 June 2001	
LANL DWG # 135Y299083		Approved By: W Sandheim
PHENIX DWG #: 082-0312-226		Drawn by: G. Hart
Filename 135Y299083 CH-DB-2 pcb		Sheet 2 of 3

Cable Label	Length
ST 1 OC 1 GAP 1	69 M (226 Ft)
ST 1 OC 1 GAP 2	69 M (226 Ft)
ST 1 OC 1 GAP 3	69 M (226 Ft)
ST 1 OC 2 GAP 1	69 M (226 Ft)
ST 1 OC 2 GAP 2	69 M (226 Ft)
ST 1 OC 2 GAP 3	69 M (226 Ft)
ST 1 OC 3 GAP 1	69 M (226 Ft)
ST 1 OC 3 GAP 2	69 M (226 Ft)
ST 1 OC 3 GAP 3	69 M (226 Ft)
ST 1 OC 4 GAP 1	69 M (226 Ft)
ST 1 OC 4 GAP 2	69 M (226 Ft)
ST 1 OC 4 GAP 3	69 M (226 Ft)
ST 1 OC 5 GAP 1	69 M (226 Ft)
ST 1 OC 5 GAP 2	69 M (226 Ft)
ST 1 OC 5 GAP 3	69 M (226 Ft)
ST 1 OC 6 GAP 1	69 M (226 Ft)
ST 1 OC 6 GAP 2	69 M (226 Ft)
ST 1 OC 6 GAP 3	69 M (226 Ft)
ST 1 OC 7 GAP 1	69 M (226 Ft)
ST 1 OC 7 GAP 2	69 M (226 Ft)
ST 1 OC 7 GAP 3	69 M (226 Ft)
ST 1 OC 8 GAP 1	69 M (226 Ft)
ST 1 OC 8 GAP 2	69 M (226 Ft)
ST 1 OC 8 GAP 3	69 M (226 Ft)

Cable Label	Length
ST 2 OC 1 GAP 1	87.9 M (288 Ft)
ST 2 OC 1 GAP 2	87.9 M (288 Ft)
ST 2 OC 1 GAP 3	87.9 M (288 Ft)
ST 2 OC 2 GAP 1	75.9 M (249 Ft)
ST 2 OC 2 GAP 2	75.9 M (249 Ft)
ST 2 OC 2 GAP 3	75.9 M (249 Ft)
ST 2 OC 3 GAP 1	60.9 M (200 Ft)
ST 2 OC 3 GAP 2	60.9 M (200 Ft)
ST 2 OC 3 GAP 3	60.9 M (200 Ft)
ST 2 OC 4 GAP 1	48.9 M (160 Ft)
ST 2 OC 4 GAP 2	48.9 M (160 Ft)
ST 2 OC 4 GAP 3	48.9 M (160 Ft)
ST 2 OC 5 GAP 1	36.9 M (121 Ft)
ST 2 OC 5 GAP 2	36.9 M (121 Ft)
ST 2 OC 5 GAP 3	36.9 M (121 Ft)
ST 2 OC 6 GAP 1	39.9 M (131 Ft)
ST 2 OC 6 GAP 2	39.9 M (131 Ft)
ST 2 OC 6 GAP 3	39.9 M (131 Ft)
ST 2 OC 7 GAP 1	51.9 M (170 Ft)
ST 2 OC 7 GAP 2	51.9 M (170 Ft)
ST 2 OC 7 GAP 3	51.9 M (170 Ft)
ST 2 OC 8 GAP 1	102.9 M (338 Ft)
ST 2 OC 8 GAP 2	102.9 M (338 Ft)
ST 2 OC 8 GAP 3	102.9 M (338 Ft)

Cable Label	Length
ST 3 OC 1 GAP 1	56.6 M (186 Ft)
ST 3 OC 1 GAP 3	56.6 M (186 Ft)
ST 3 OC 2 GAP 1	48.6 M (159 Ft)
ST 3 OC 2 GAP 3	48.6 M (159 Ft)
ST 3 OC 3 GAP 1	38.6 M (127 Ft)
ST 3 OC 3 GAP 3	38.6 M (127 Ft)
ST 3 OC 4 GAP 1	30.6 M (100 Ft)
ST 3 OC 4 GAP 3	30.6 M (100 Ft)
ST 3 OC 5 GAP 1	22.6 M (74 Ft)
ST 3 OC 5 GAP 3	22.6 M (74 Ft)
ST 3 OC 6 GAP 1	24.6 M (81 Ft)
ST 3 OC 6 GAP 3	24.6 M (81 Ft)
ST 3 OC 7 GAP 1	32.6 M (107 Ft)
ST 3 OC 7 GAP 3	32.6 M (107 Ft)
ST 3 OC 8 GAP 1	66.6 M (219 Ft)
ST 3 OC 8 GAP 3	66.6 M (219 Ft)

Each cable will have two Labels, one on each end.

.

Location shown on Sheet 1

Total number of cables = 64

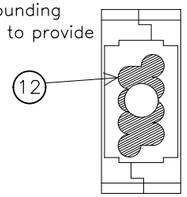
ASSEMBLY DRAWING

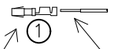
Labels & Cable Lengths

Los Alamos National Laboratory		
Title	MUON TRACKING HV DIST. SYSTEM	
HV Cable, Chamber to HV Distribution Box		
Size C	Date Originated: 31 May 2001	
	Date Last Revised: 7 June 2001	
LANL DWG # 135Y299083		Approved By: W. Sondheim
PHENIX DWG #: 002-0312-226		Drawn by: G. Hart
Filename 135Y299083 CH-DB-1.pcb		Sheet 3 of 3

ITEM	QTY	MANUFACTURER	DESCRIPTION	PART #	Source	Cat #	Cost/ea
1	1	AMP (Div of Tyco)	LGH 9 Pin HV Connector Kit (includes sockets)	443161-1	Discontinued		
2	1	AMP (Div of Tyco)	LGH Strain Relief Kit (Includes hardware)	443162-1	Discontinued		
3	1	AMP (Div of Tyco)	Block Connector, 20 Pin, HV rated, Female	203909-2	Newark Electronics		12.00
4	8	AMP (Div of Tyco)	Socket, Type III, for 20-24 AWG Wire, .071" OD	66105-1	Newark Electronics	50F576	.80
6	2	AMP (Div of Tyco)	Socket, Type III, for 16 AWG Wire, .088" Dia	66101-1	Newark Electronics	50F573	.80
7	1	General Wire Prod.	Custom 11 Cond. Shielded HV Cable	001-21919 Rev B	Newark Electronics		.45/ft
8	1	Belden	Hook-up Wire, 22 AWG, Teflon, Green, 70 mm (2.7 in) long	83026-100-5	Newark Electronics	02F5834	.05
9	1	Belden	Hook-up Wire, 16 AWG, Teflon, Green, 35 mm (1.4 in) long	83030-100-5	Newark Electronics	02F5420	.05
10	1	Nalgene	PVC Tubing, Clear, 19mm (3/4") long, 3/8" ID, 1/2" OD	8000-0120	Fischer Scientific	14-176-36	.02
11	2		Cable Label, see sheet 3 for text				
12	1/8 oz	GC Electronics	Silicone Sealant/Adhesive, Electronic Grade, Clear, 3 oz Tube	19-155	Newark Electronics	00Z1554	.30

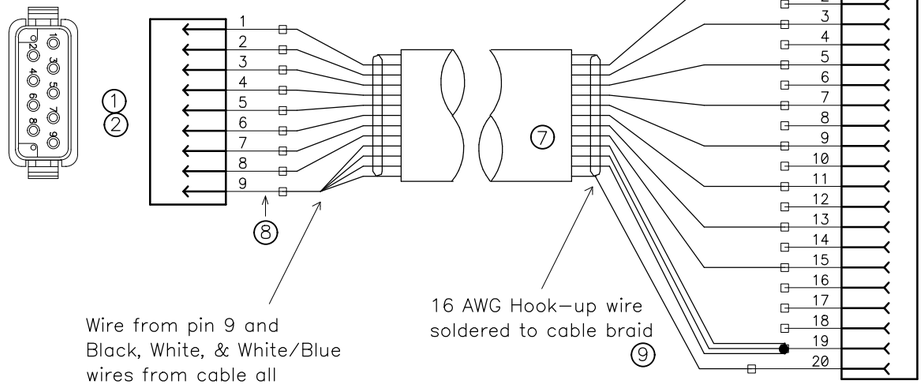
Rear view of assembled connector. Fill voids surrounding cable with Silicone sealant to provide strain releif.





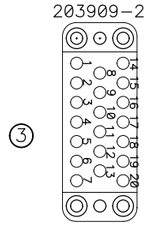
Strip wire ends to expose 3.6 mm (.14 in) wire

Note: The socket contacts supplied in the package of the LHV connectors are AMP Type XI. Part number 203802-6. AMP recommended hand crimp tool is P/N 90260-1. Extration Tool is P/N 91038-3



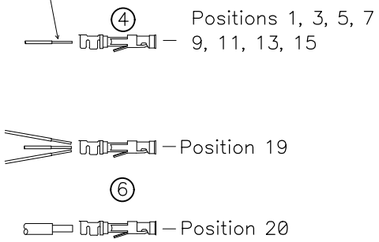
Wire from pin 9 and Black, White, & White/Blue wires from cable all soldered to cable braid

16 AWG Hook-up wire soldered to cable braid

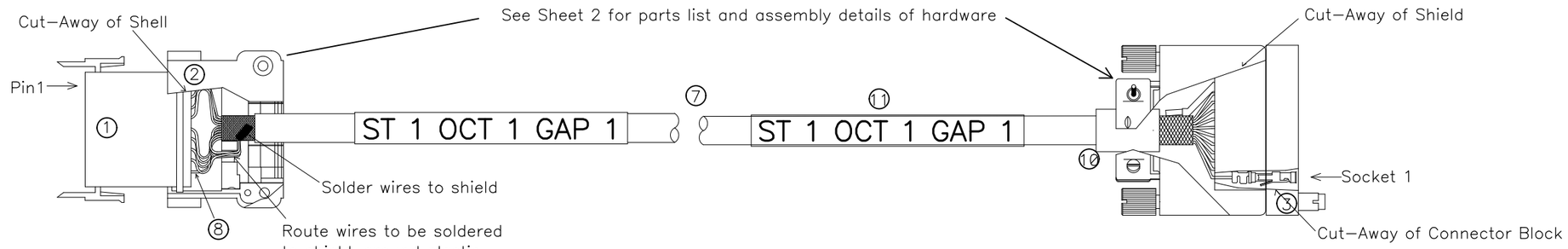


As viewed from socket insertion side (rear)

Strip wire ends to expose 5.2 mm (.2 in) wire



Use AMP Crimper 58495-1



9 Pin LGH Connector Position	Color of HV Cable Wires
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Violet
8	Gray
9	Black
9	White
9	White & Blue
9	Shield Braid

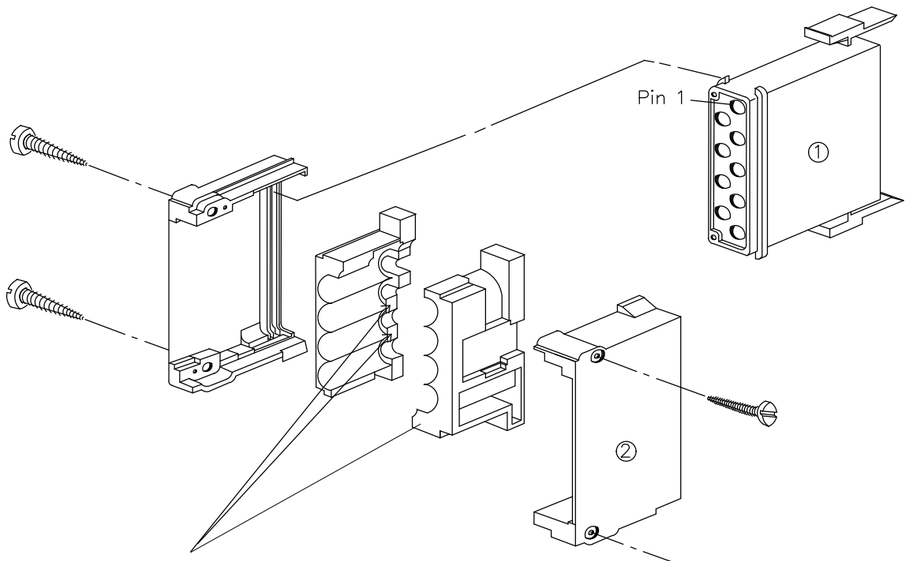
20 PIN Connector Position	Color of HV Cable Wires
1	Brown
3	Red
5	Orange
7	Yellow
9	Green
11	Blue
13	Violet
15	Gray
19	Black
19	White
19	White & Blue

ASSEMBLY DRAWING

SCHEMATIC & CABLE WIRING DETAILS

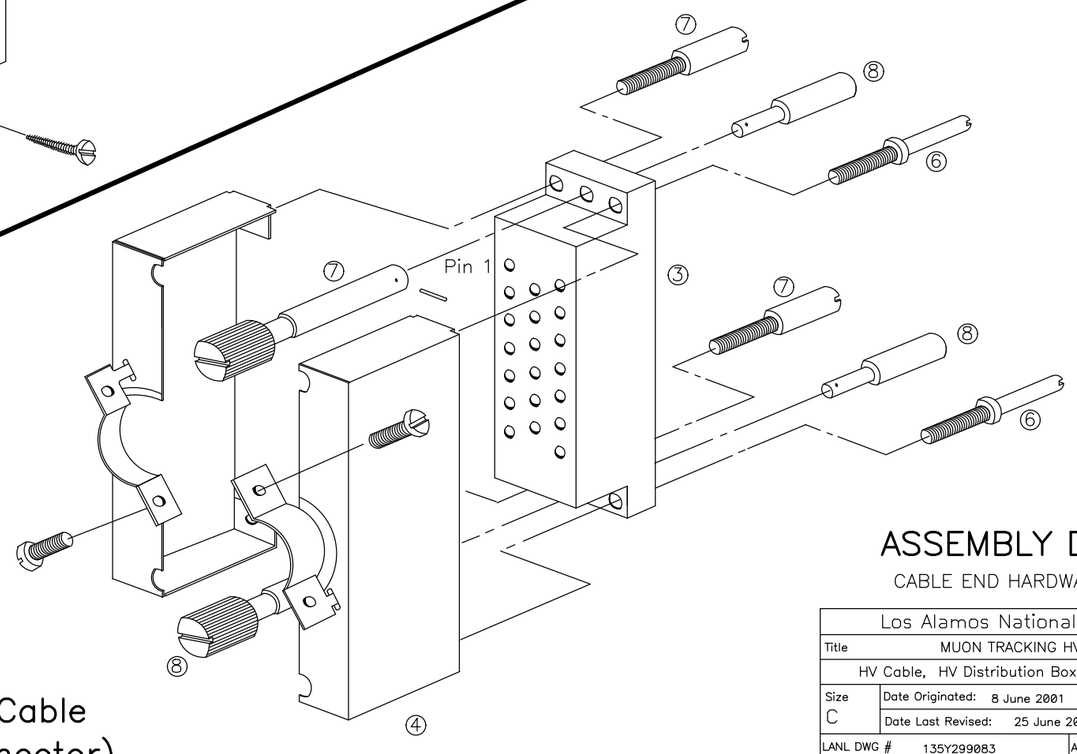
Los Alamos National Laboratory		
Title	MUON TRACKING HV DIST. SYSTEM	
HV Cable, Distribution Box to HV Power Supply		
Size C	Date Originated: 31 May 2001	
	Date Last Revised: 3 July 2001	
LANL DWG # 135Y299083		Approved By: W. Sondheim
PHENIX DWG #: 002-0312-226		Drawn by: G. Hart
Filename 135Y299083 DB-PS-1.pcb		Sheet 1 of 3

ITEM	QTY	MANUFACTURER	DESCRIPTION	PART #	Source	Cat #	Cost/ea
1	1	AMP (Div of Tyco)	LGH 9 Pin Connector Kit	443161-1	See SHEET 1		
2	1	AMP (Div of Tyco)	LGH 9 Pin Strain Relief Kit	443162-1	See SHEET 1		
3	1	AMP (Div of Tyco)	Block Connector, 20 Pin, HV rated, Female	203909-2	See SHEET 1		
4	1	AMP (Div of Tyco)	Shield Kit, Short, M-Series, Two-Piece, with screws & clamps	200517-2	Digi-Key	200517-2-ND	11.00
6	2	AMP (Div of Tyco)	Guide Pin, for Type M Connectors	200833-2	Newark Electronics	50F656	1.00
7	2	AMP (Div of Tyco)	Guide Socket, for Type M Connectors	200835-2	Newark Electronics	50F657	1.43
8	2	AMP (Div of Tyco)	Jackscrew Kit, Female, For type M Connectors	200867-1	Newark Electronics	50F659	2.62



HV Power Supply End of Cable (9 Pin LGH Connector))

Cut off two tabs on both of these inner clamp pieces (to make room for cable)



HV Distribution Box End of Cable (Sockets in 203909-2 connector)

ASSEMBLY DRAWING

CABLE END HARDWARE DETAILS

Los Alamos National Laboratory		
Title	MUON TRACKING HV DIST. SYSTEM	
HV Cable, HV Distribution Box to Power Supply		
Size C	Date Originated: 8 June 2001	
	Date Last Revised: 25 June 2001	
LANL DWG # 135Y299083		Approved By: W. Sondheim
PHENIX DWG #: 002-0312-226		Drawn by: G. Hart
Filename 135Y299083 DB-PS-2.pcb		Sheet 2 of 3

Cable Label	Length
ST 1 OC 1 GAP 1	2 M (80 in)
ST 1 OC 1 GAP 2	2 M (80 in)
ST 1 OC 1 GAP 3	2 M (80 in)
ST 1 OC 2 GAP 1	2 M (80 in)
ST 1 OC 2 GAP 2	2 M (80 in)
ST 1 OC 2 GAP 3	2 M (80 in)
ST 1 OC 3 GAP 1	2 M (80 in)
ST 1 OC 3 GAP 2	2 M (80 in)
ST 1 OC 3 GAP 3	2 M (80 in)
ST 1 OC 4 GAP 1	2 M (80 in)
ST 1 OC 4 GAP 2	2 M (80 in)
ST 1 OC 4 GAP 3	2 M (80 in)
ST 1 OC 5 GAP 1	2 M (80 in)
ST 1 OC 5 GAP 2	2 M (80 in)
ST 1 OC 5 GAP 3	2 M (80 in)
ST 1 OC 6 GAP 1	2 M (80 in)
ST 1 OC 6 GAP 2	2 M (80 in)
ST 1 OC 6 GAP 3	2 M (80 in)
ST 1 OC 7 GAP 1	2 M (80 in)
ST 1 OC 7 GAP 2	2 M (80 in)
ST 1 OC 7 GAP 3	2 M (80 in)
ST 1 OC 8 GAP 1	2 M (80 in)
ST 1 OC 8 GAP 2	2 M (80 in)
ST 1 OC 8 GAP 3	2 M (80 in)

Cable Label	Length
ST 2 OC 1 GAP 1 & 2	2 M (80 in)
ST 2 OC 1 GAP 3 OCT 2 GAP 1	2 M (80 in)
ST 2 OC 2 GAP 2 & 3	2 M (80 in)
ST 2 OC 3 GAP 1 & 2	2 M (80 in)
ST 2 OC 3 GAP 3 OCT 4 GAP 1	2 M (80 in)
ST 2 OC 4 GAP 2 & 3	2 M (80 in)
ST 2 OC 5 GAP 1 & 2	2 M (80 in)
ST 2 OC 5 GAP 3 OCT 6 GAP 1	2 M (80 in)
ST 2 OC 6 GAP 2 & 3	2 M (80 in)
ST 2 OC 7 GAP 1 & 2	2 M (80 in)
ST 2 OC 7 GAP 3 OCT 8 GAP 1	2 M (80 in)
ST 2 OC 8 GAP 2 & 3	2 M (80 in)

Cable Label	Length
ST 3 OC 1 GAP 1 & 3	2 M (80 in)
ST 3 OC 2 GAP 1 & 3	2 M (80 in)
ST 3 OC 3 GAP 1 & 3	2 M (80 in)
ST 3 OC 4 GAP 1 & 3	2 M (80 in)
ST 3 OC 5 GAP 1 & 3	2 M (80 in)
ST 3 OC 6 GAP 1 & 3	2 M (80 in)
ST 3 OC 7 GAP 1 & 3	2 M (80 in)
ST 3 OC 8 GAP 1 & 3	2 M (80 in)

Each cable will have two Labels, one on each end.

.

Location shown on Sheet 1

Total number of cables = 44

ASSEMBLY DRAWING

Labels & Cable Lengths

Los Alamos National Laboratory		
Title	MUON TRACKING HV DIST. SYSTEM	
Cable, Distribution Box to HV Power Supply		
Size C	Date Originated: 31 May 2001	
	Date Last Revised: 12 June 2001	
LANL DWG #: 135Y299083		Approved By: W Sandheim
PHENIX DWG #: 002-0312-226		Drawn by: G. Hart
Filename 135Y299083 DB-PS-3.pcb		Sheet 3 of 3

Station 1 North HV Distribution Chamber Inputs

Oct 1 Gap 1 Oct 1 Gap 2 Oct 1 Gap 3 Oct 2 Gap 1 Oct 2 Gap 2 Oct 2 Gap 3 Oct 3 Gap 1 Oct 3 Gap 2 Oct 3 Gap 3 Oct 4 Gap 1 Oct 4 Gap 2 Oct 4 Gap 3

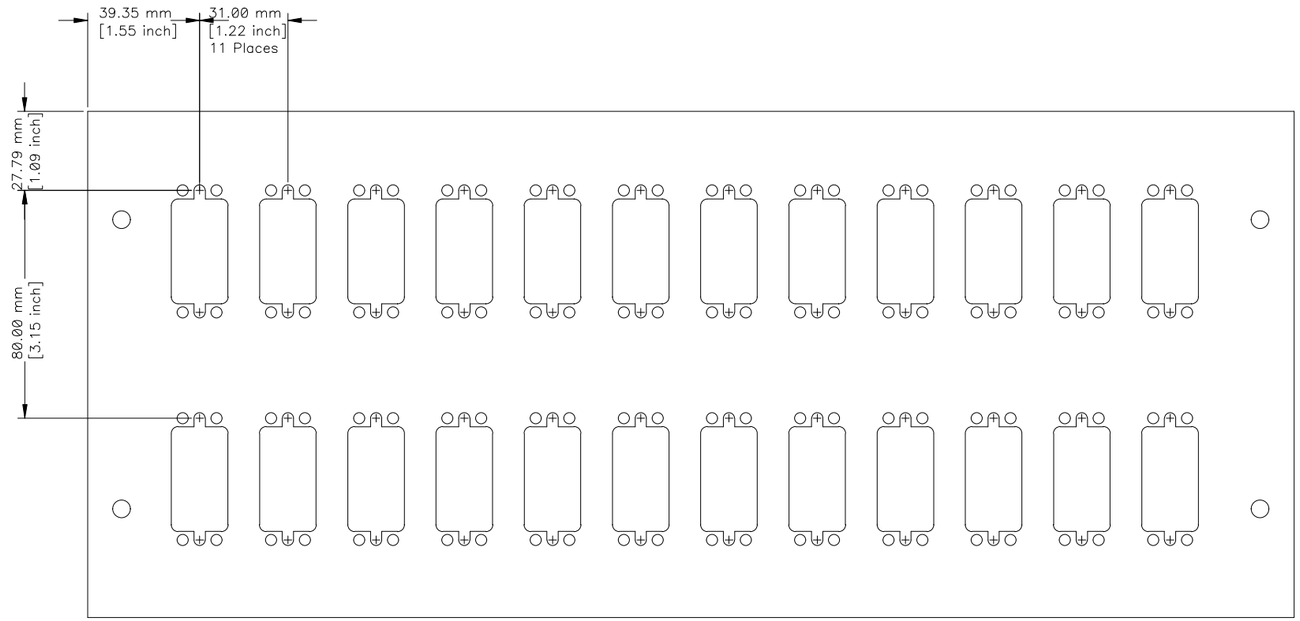
Oct 5 Gap 1 Oct 5 Gap 2 Oct 5 Gap 3 Oct 6 Gap 1 Oct 6 Gap 2 Oct 6 Gap 3 Oct 7 Gap 1 Oct 7 Gap 2 Oct 7 Gap 3 Oct 8 Gap 1 Oct 8 Gap 2 Oct 8 Gap 3

LANL 135Y299083 / PHENIX 002-0312-226

Silkscreen in Black

Front Panel Silkscreen

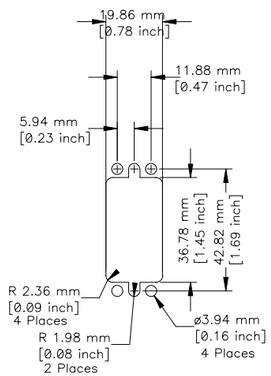
Los Alamos National Laboratory		
Title	Front Panel	
Noth Arm HV Distribution		
Size D	Date Originated: 30 May 2001	
	Date Last Revised: 7 June 2001	
LANL DWG # 135Y299083		Approved By: W. Sondheim
PHENIX DWG #: 002-0312-226		Drawn by: G. Hart
Filename 135Y299083 FP 1.pcb		Sheet 2 of 3



Front View
(Front Side has peel off film)

Front Side

Paint or anodize front side in Red

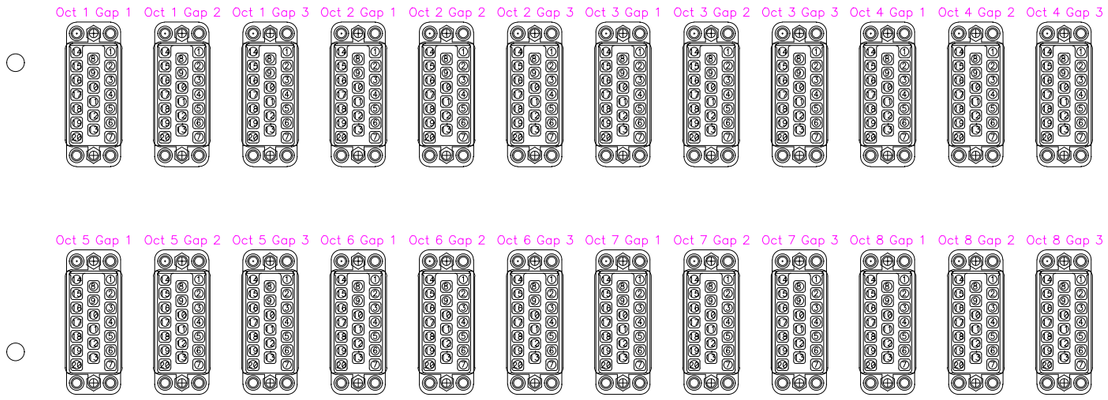


Front Panel Fabrication Drawing

Los Alamos National Laboratory		
Title	Front Panel	
Noth Arm HV Distribution		
Size D	Date Originated: 30 May 2001	
	Date Last Revised: 7 June 2001	
LANL DWG # 135Y299083		Approved By: W. Sondheim
PHENIX DWG #: 002-0312-226		Drawn by: G. Hart
Filename 135Y299083 FP 1.pcb		Sheet 1 of 3

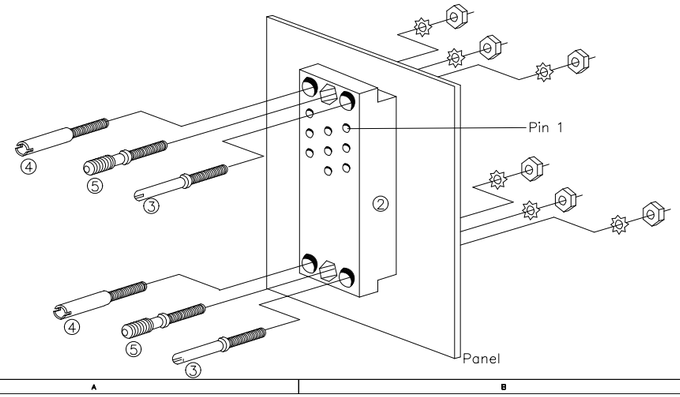
ITEM	QTY	MANUFACTURER	DESCRIPTION	PART #	Source	Cat #	Cost/ea
1	1	Bud Industries	.125" Aluminum Front Panel, Part of NHC-14157 Enclosure	SFA-1834	Newark Electronics	91F268	20.00
2	24	AMP (Div of Tyco)	Block Connector, 20 Pin, HV rated, Female	203909-2	Newark Electronics		12.00
3	48	AMP (Div of Tyco)	Guide Pin, for Type M Connectors (Includes washer & nut)	200833-2	Newark Electronics	50F656	1.00
4	48	AMP (Div of Tyco)	Guide Socket, for Type M Connectors (Includes washer & nut)	200835-2	Newark Electronics	50F657	1.43
5	48	AMP (Div of Tyco)	Jackscrew, Male, Fixed, (Includes washer & nut)	200874-1	Newark Electronics	50F661	.81

Station 1 North HV Distribution Chamber Inputs



① LANL 135Y299083 / PHENIX 002-0312-226

Assembly Detail



Front Panel Assembly Drawing

Los Alamos National Laboratory		
Title	Front Panel	
	Noth Arm HV Distribution	
Size D	Date Originated: 30 May 2001	
	Date Last Revised: 7 June 2001	
LANL DWG #: 135Y299083		Approved By: W. Sondheim
PHENIX DWG #: 002-0312-226		Drawn by: G. Hart
Filename 135Y299083 FP 1.pcb		Sheet 3 of 3

Oct 4 Gap 3 Oct 4 Gap 2 Oct 4 Gap 1 Oct 3 Gap 3 Oct 3 Gap 2 Oct 3 Gap 1 Oct 2 Gap 3 Oct 2 Gap 2 Oct 2 Gap 1 Oct 1 Gap 3 Oct 1 Gap 2 Oct 1 Gap 1

Station 1 North HV Distribution HV Inputs from Power Supply

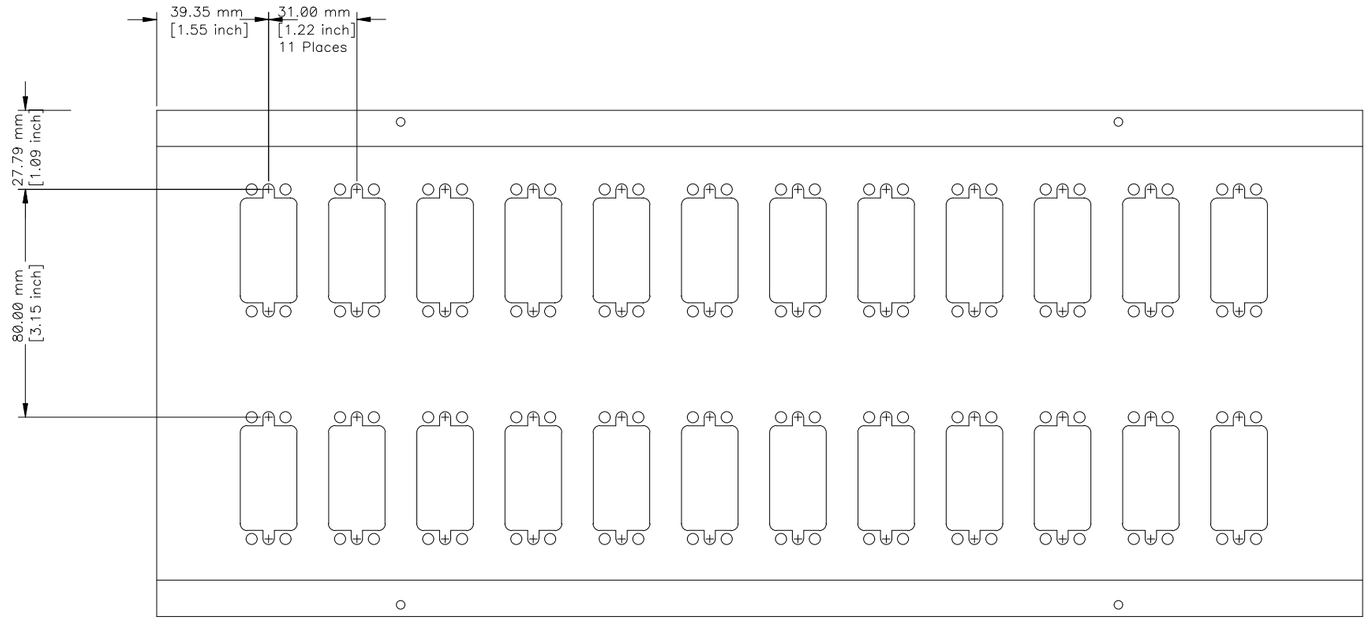
Oct 8 Gap 3 Oct 8 Gap 2 Oct 8 Gap 1 Oct 7 Gap 3 Oct 7 Gap 2 Oct 7 Gap 1 Oct 6 Gap 3 Oct 6 Gap 2 Oct 6 Gap 1 Oct 5 Gap 3 Oct 5 Gap 2 Oct 5 Gap 1

LANL 135Y299083 / PHENIX 002-0312-226

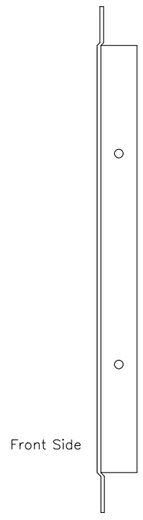
Silkscreen in Black

Rear Panel Silkscreen

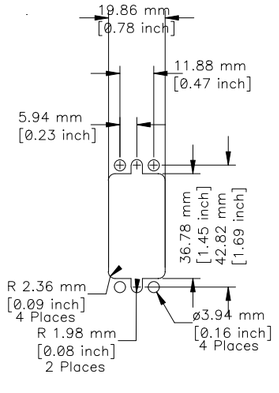
Los Alamos National Laboratory		
Title	Rear Panel	
Noth Arm HV Distribution		
Size D	Date Originated: 30 May 2001	
	Date Last Revised: 14 June 2001	
LANL DWG # 135Y299083		Approved By: W. Sondheim
PHENIX DWG #: 002-0312-226		Drawn by: G. Hart
Filename 135Y299083 RP 1.pcb		Sheet 2 of 3



Front View
(Front side is prepainted white)



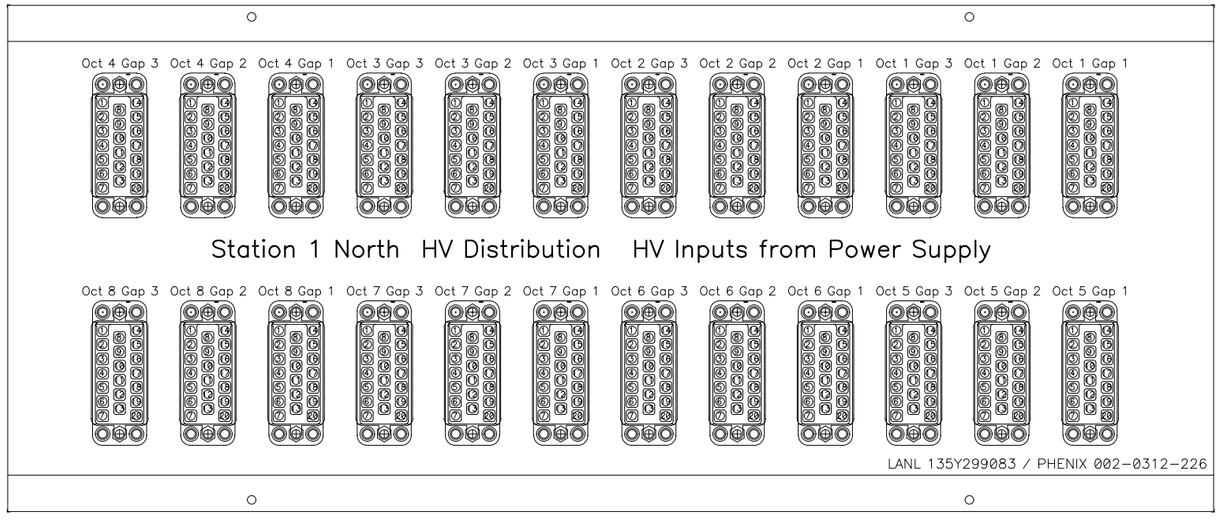
Front Side

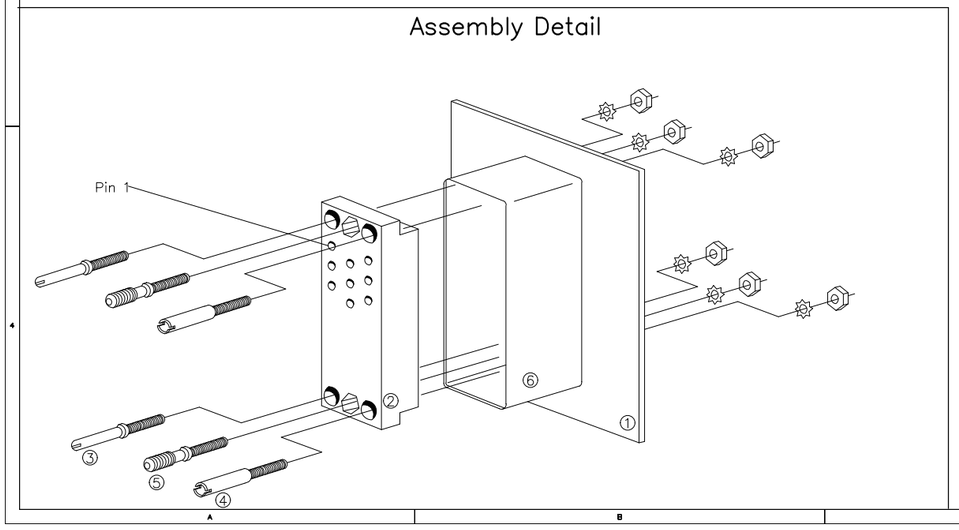


Rear Panel Fabrication Drawing

Los Alamos National Laboratory		
Title	Rear Panel	
	Noth Arm HV Distribution	
Size D	Date Originated: 30 May 2001	
	Date Last Revised: 14 June 2001	
LANL DWG # 135Y299883		Approved By: W. Sondheim
PHENIX DWG #: 002-0312-226		Drawn by: G. Hart
Filename 135Y299883 RP 1.pcb		Sheet 1 of 3

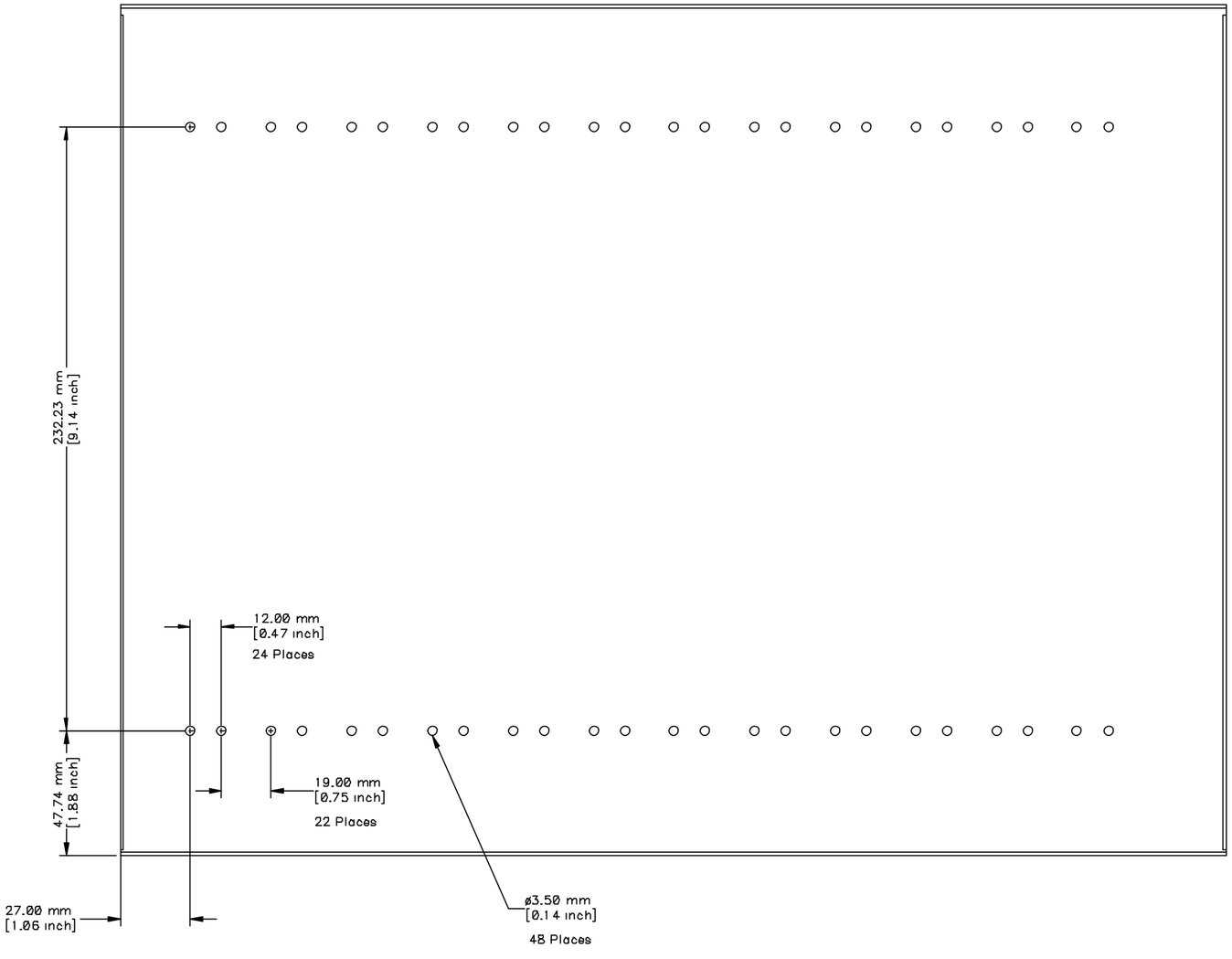
ITEM	QTY	MANUFACTURER	DESCRIPTION	PART #	Source	Cat #	Cost/ea
1	1	Bud Industries	.060" Aluminum Rear Panel, Part of NHC-14157 Enclosure	NHC-14157	Newark Electronics	52F6486	144.00
2	24	AMP (Div of Tyco)	Block Connector, 20 Pin, HV rated	203908-2	Newark Electronics		12.00
3	48	AMP (Div of Tyco)	Guide Pin, for Type M Connectors (Includes washer & nut)	200833-2	Newark Electronics	50F656	1.00
4	48	AMP (Div of Tyco)	Guide Socket, for Type M Connectors (Includes washer & nut)	200835-2	Newark Electronics	50F657	1.43
5	48	AMP (Div of Tyco)	Jackscrew, Male, Fixed, (Includes washer & nut)	200874-1	Newark Electronics	50F661	.81
6	24	AMP (Div of Tyco)	Pin Hood, Internal, for type M connector	202434-1	Newark Electronics		6.00

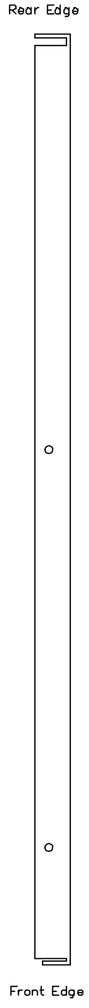




ST 1 Rear Panel Assembly Drawing

Los Alamos National Laboratory		
Title	Rear Panel	
	Noth Arm HV Distribution	
Size D	Date Originated: 30 May 2001	
	Date Last Revised: 14 June 2001	
LANL DWG #: 135Y299083		Approved By: W. Sondheim
PHENIX DWG #: 002-0312-226		Drawn by: G. Hart
Filename 135Y299083 RP 1.pcb		Sheet 3 of 3

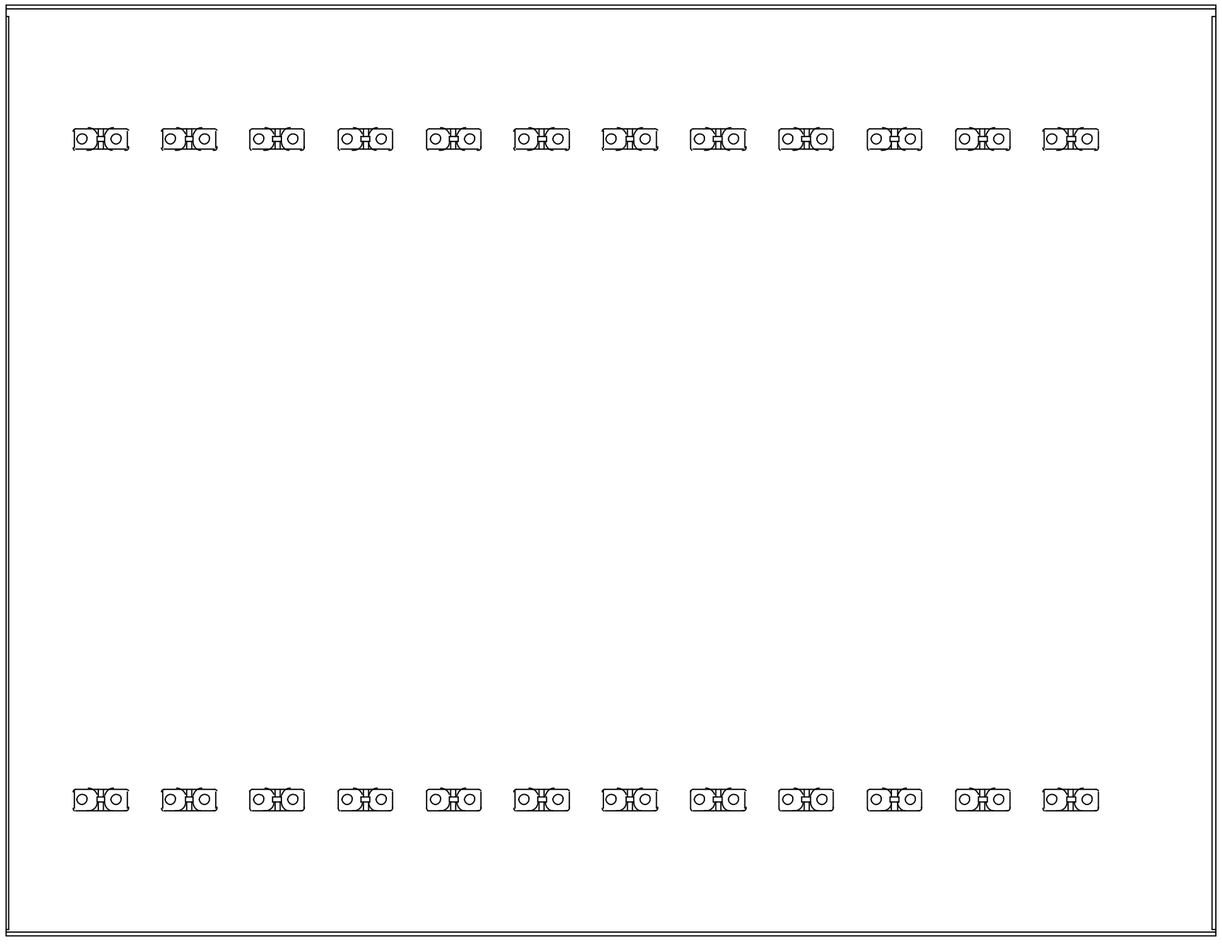


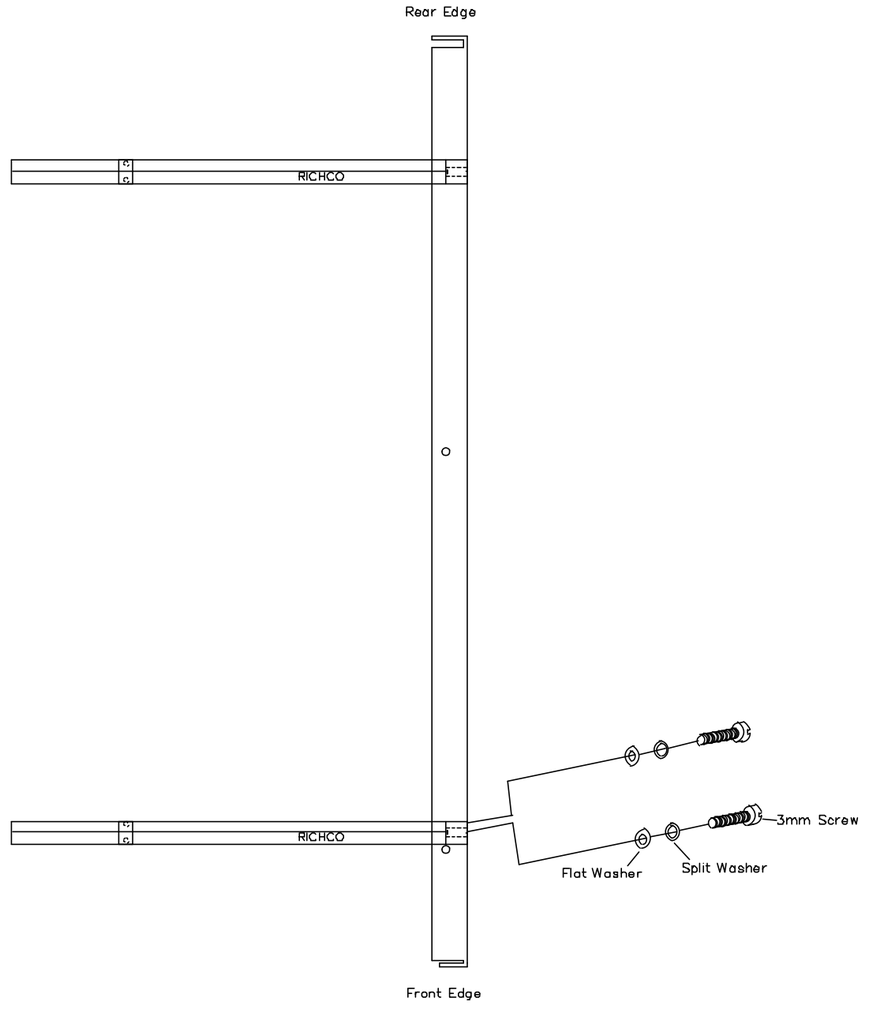


Bottom Panel Fabrication Drawing

Los Alamos National Laboratory		
Title:	Bottom Panel Nath Arm HV Distribution	
Size: D	Date Originated: 31 May 2021 Date Last Revised: 31 May 2021	
LANL DWG #: 135Y290383		Approved By: W. Sondheim
PHENIX DWG #: 002-8312-226		Drawn by: C. Hart
Filename: 135Y290383 BP 1.pdb		Sheet 1 of 2

ITEM	QTY	MANUFACTURER	DESCRIPTION	PART #	Source	Cat #	Cost/ea
1	1	Bud Industries	.050" Aluminum bottom Panel, Part of NHC-14157 Enclosure	NHC-14157	Newark Electronics	56F6486	144.00
2	24	SPC Technology	Vertical Mount Card Guides (with mounting hardware)	2642	Newark Electronics	92N4857	1.00



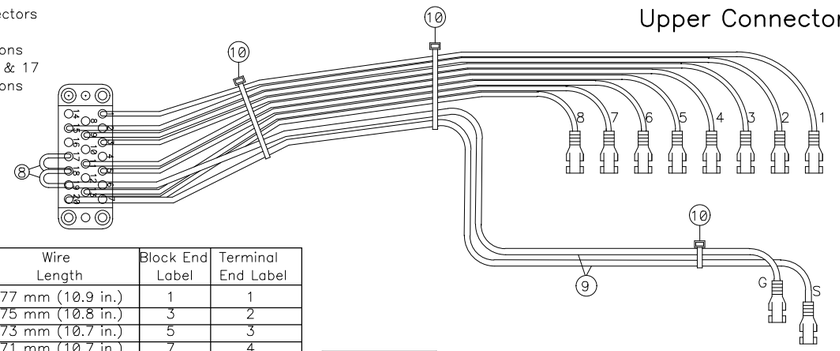


Bottom Panel Assembly Drawing

Los Alamos National Laboratory			
Title:	Bottom Panel Nath Arm HV Distribution		
Size: D	Date Originated: 31 May 2001 Date Last Revised: 31 May 2001		
LANL DWG #:	135Y290883	Approved By:	W. Sondheim
PHENIX DWG #:	662-8112-226	Drawn by:	C. Hart
Filename:	135Y290883 BP 1.pcb	Sheet 2	of 2

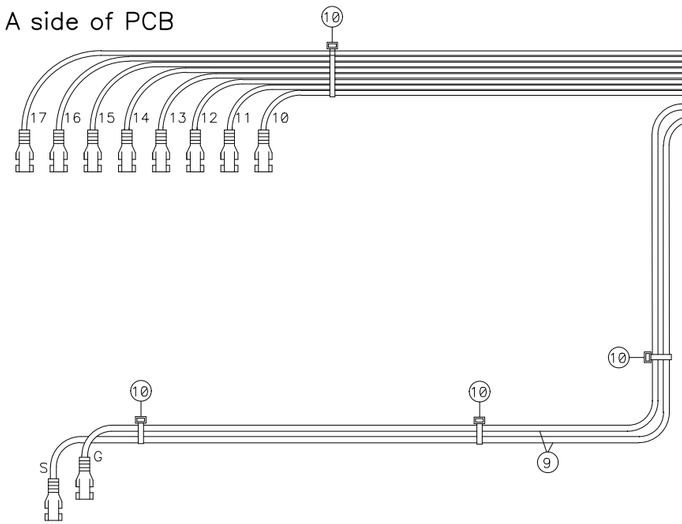
Upper Connector Blocks to A side of PCB

Front Panel Block Connectors
(Rear View)
Item 2, sockets in positions
1, 3, 5, 7, 9, 11, 13, 15, & 17
Item 3, sockets in positions
18, 19 & 20

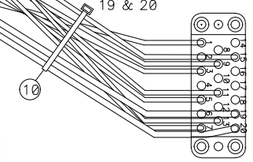


Block Position	Wire Type	Wire Length	Block End Label	Terminal End Label
1	24 AWG HV	277 mm (10.9 in.)	1	1
3	24 AWG HV	275 mm (10.8 in.)	3	2
5	24 AWG HV	273 mm (10.7 in.)	5	3
7	24 AWG HV	271 mm (10.7 in.)	7	4
9	24 AWG HV	243 mm (9.6 in.)	9	5
11	24 AWG HV	241 mm (9.5 in.)	11	6
13	24 AWG HV	239 mm (9.4 in.)	13	7
15	24 AWG HV	208 mm (8.2 in.)	15	8
19	16 AWG H/U	251 mm (9.9 in.)	19	G
20	16 AWG H/U	256 mm (10.1 in.)	20	S
17–18	22 AWG H/U	40 mm (1.6 in.)		
18–19	22 AWG H/U	40 mm (1.6 in.)		

12 SETS



Rear Panel Block Connectors
(Rear View)
Item 5, pins in positions
1, 3, 5, 7, 9, 11, 13, & 15
Item 6, pins in positions
19 & 20

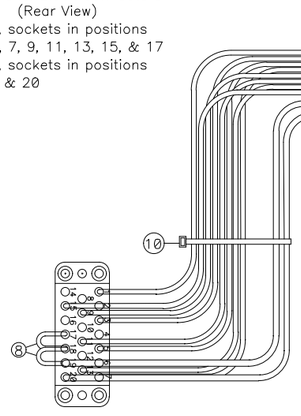


12 SETS

Block Position	Wire Type	Wire Length	Block End Label	Terminal End Label
1	24 AWG HV	369 mm (14.5 in.)	1	10
3	24 AWG HV	391 mm (15.4 in.)	3	11
5	24 AWG HV	413 mm (16.3 in.)	5	12
7	24 AWG HV	435 mm (17.1 in.)	7	13
9	24 AWG HV	419 mm (16.5 in.)	9	14
11	24 AWG HV	441 mm (17.4 in.)	11	15
13	24 AWG HV	463 mm (18.2 in.)	13	16
15	24 AWG HV	457 mm (18 in.)	15	17
19	16 AWG H/U	352 mm (13.9 in.)	19	G
20	16 AWG H/U	358 mm (14.1 in.)	20	S

Lower Connector Blocks to B side of PCB

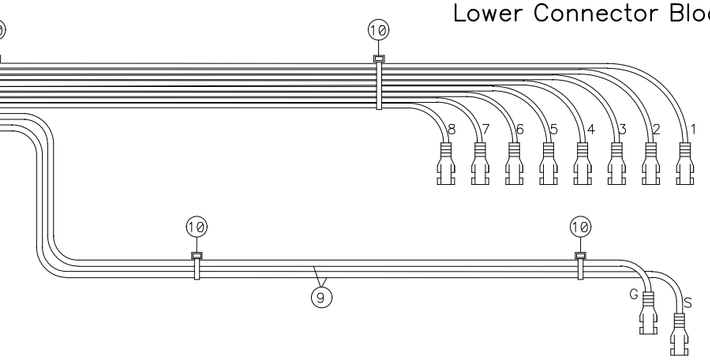
Front Panel Block Connectors
(Rear View)
Item 2, sockets in positions
1, 3, 5, 7, 9, 11, 13, 15, & 17
Item 3, sockets in positions
18, 19 & 20

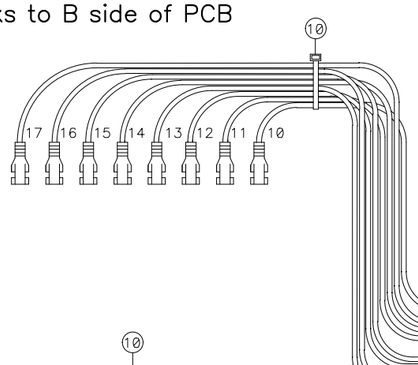


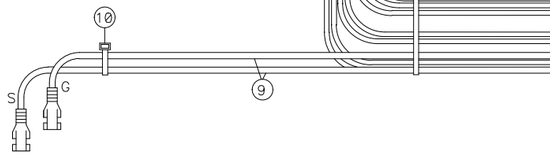
Front Panel Block Connectors
with Socket Contacts
(Rear View)

12 SETS

Block Position	Wire Type	Wire Length	Block End Label	Terminal End Label
1	24 AWG HV	467 mm (18.4 in.)	1	1
3	24 AWG HV	465 mm (18.3 in.)	3	2
5	24 AWG HV	463 mm (18.2 in.)	5	3
7	24 AWG HV	461 mm (18.1 in.)	7	4
9	24 AWG HV	433 mm (17 in.)	9	5
11	24 AWG HV	431 mm (17 in.)	11	6
13	24 AWG HV	429 mm (16.9 in.)	13	7
15	24 AWG HV	400 mm (15.7 in.)	15	8
19	16 AWG H/U	442 mm (17.4 in.)	19	G
20	16 AWG H/U	452 mm (17.8 in.)	20	S
17–18	22 AWG H/U	40 mm (1.6 in.)		
18–19	22 AWG H/U	40 mm (1.6 in.)		







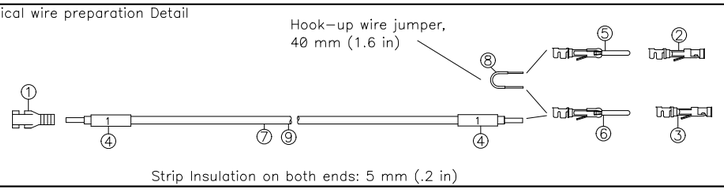
Rear Panel Block Connectors
(Rear View)
Item 5, pins in positions
1, 3, 5, 7, 9, 11, 13, & 15
Item 6, pins in positions
19 & 20

12 SETS

Block Position	Wire Type	Wire Length	Block End Label	Terminal End Label
1	24 AWG HV	338 mm (13.3 in.)	1	10
3	24 AWG HV	360 mm (14.2 in.)	3	11
5	24 AWG HV	382 mm (15 in.)	5	12
7	24 AWG HV	404 mm (15.9 in.)	7	13
9	24 AWG HV	390 mm (15.4 in.)	9	14
11	24 AWG HV	412 mm (16.2 in.)	11	15
13	24 AWG HV	434 mm (17.1 in.)	13	16
15	24 AWG HV	417 mm (16.4 in.)	15	17
19	16 AWG H/U	321 mm (12.6 in.)	19	G
20	16 AWG H/U	327 mm (12.9 in.)	20	S

Note: This drawing does not illistrate finished cable bundles.
Wires are shown to clarify wiring and is not intended to
be to finished scale

Typical wire preparation Detail

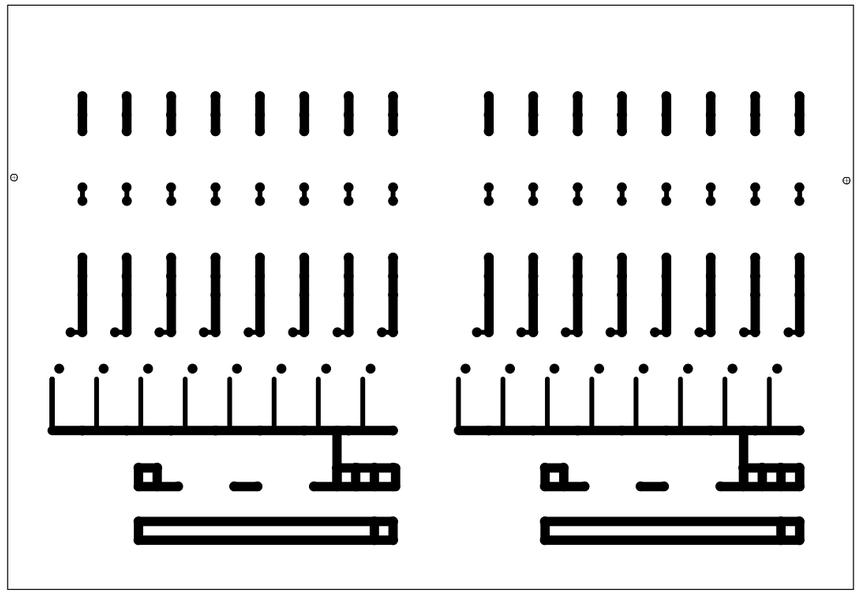


Strip Insulation on both ends: 5 mm (.2 in)

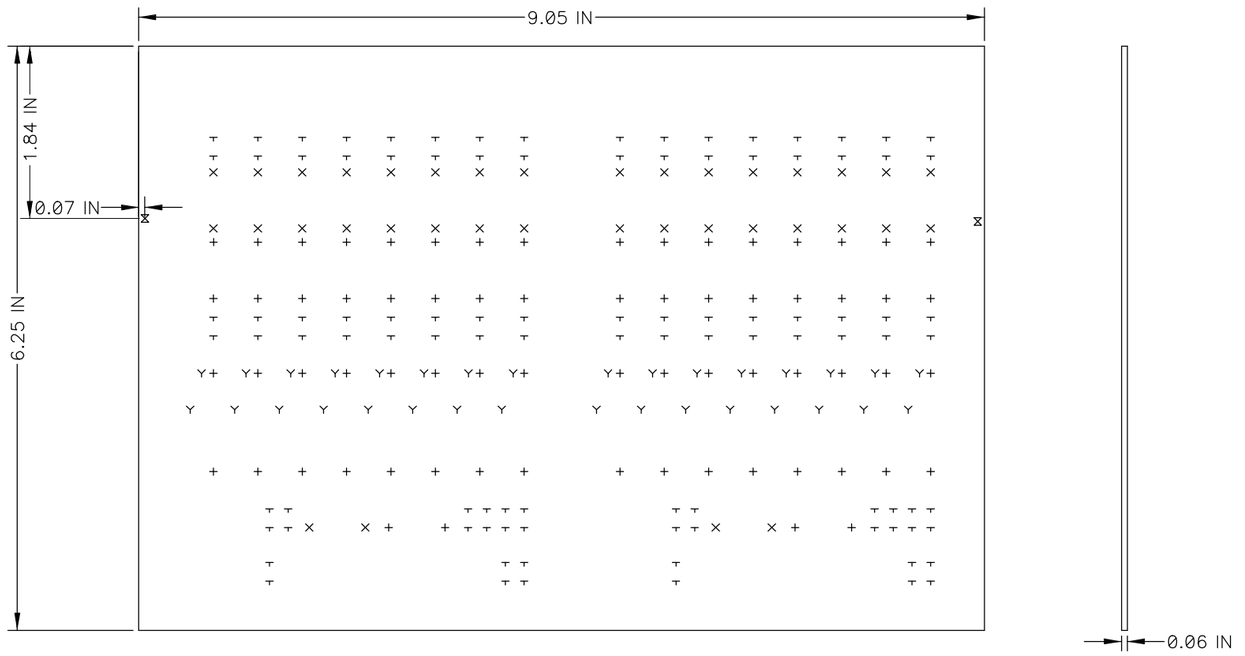
ITEM	QTY	MANUFACTURER	DESCRIPTION	PART #	Source	Cat #	Cost/ea
1	480	VOLTREX	Terminal, Solderless (Crimp) Tab, .187", Non–Insulated	CFS–TO–1818	Newark Electronics	31N2875	.08
2	216	AMP (Div of Tyco)	Contact, Socket, Type III, for 20–24 AWG Wire, Crimp	66105–1	Newark Electronics	50F576	.80
3	72	AMP (Div of Tyco)	Contact, Socket, Type III, for 16–18 AWG Wire, Crimp	66101–1	Newark Electronics	50F573	.80
4*	21	Panduit	Label, Wire, supplied on rolls	see table A	Newark Electronics	87F4587	24.00
5	192	AMP (Div of Tyco)	Contact, Pin, Type III, for 20–24 AWG Wire, Crimp	66103–1	Newark Electronics	50F575	.60
6	24	AMP (Div of Tyco)	Contact, Pin, Type III, for 16–18 AWG Wire, Crimp	66099–1	Newark Electronics	50F676	.60
7	203 M	Judd Wire	HV Wire, 24 AWG, 5 KV Rated, Red	V0505003	Summit Electric		.12 / M
8	2 M	Belden	Hook–up Wire, 22 AWG, Green, Teflon	83026–100–5	Newark Electronics	02F5834	.85 / M
9	32 M	Belden	Hook–up Wire, 16 AWG, Green, Teflon	83030–100–5	Newark Electronics	02F5420	1.30 / M
10	216	PANDUIT	Cable Ties, .6" max bundle, Pkg of 1000	PLT.6SM–M	Newark Electronics	84F1314	.03

TABLE A		
Label	Qty needed	Legend TYPE:
1	72	PMDR–1
2	24	PMDR–2
3	72	PMDR–3
4	24	PMDR–4
5	72	PMDR–5
6	24	PMDR–6
7	72	PMDR–7
8	24	PMDR–8
9	48	PMDR–9
10	24	PMDR–10
11	72	PMDR–11
12	24	PMDR–12
13	72	PMDR–13
14	24	PMDR–14
15	72	PMDR–15
16	24	PMDR–16
17	24	PMDR–17
19	48	PMDR–19
20	48	PMDR–20
S	48	PMDR–S
G	48	PMDR–G

Los Alamos National Laboratory		
Title	St 1 N Panel Connector to PCB Wires	
	Noth Arm HV Distribution	
Size D	Date Originated: 14 June 2001	
	Date Last Revised: 23 July 2001	
LANL DWG #: 135Y299883		Approved By: W. Sondheim
PHENIX DWG #: 002–0312–226		Drawn by: G. Hart
Filename: 135Y299883 DB WIRE 1.pcb		Sheet 1 of 1



135Y299083 Layer 2 (Bottom)
26 June 2001



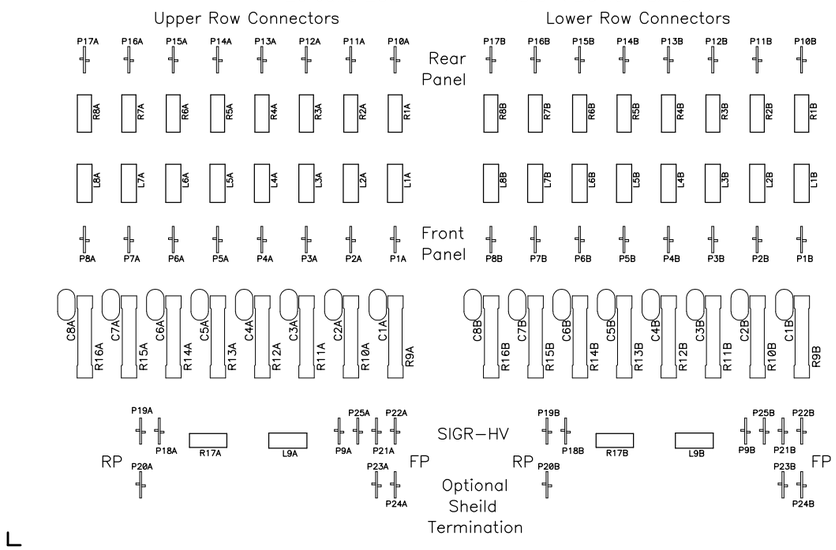
Drill Table			
Hole Dia (mm)	Symbol	Quantity	Plated
0.760	+	68	No
0.860	X	36	No
1.295	Y	32	No
1.300	⊤	100	No
2.200	⧖	2	No

1. Interpret drawings per IPC–D–275, Manufacture Printed Wiring Board (PWB) to best commercial practice per IPC–600, Class 2
2. Material: Fabricate from reinforced FR–4 glass laminate
3. Dimensions shown are finished size
4. All tolerance to be =/– .005" (.127 mm) unless otherwise stated
5. NC Drill and Gerber File formats specified in read me file:135Y299083 readme.txt
6. Silkscreen Layer 1, White Lettering
7. Solder Mask Layer 2, Red color preferred

Los Alamos National Laboratory		
Title	HV Board	
	North Arm HV Dist. System	
Size C	Date Originated: 23 May 2001	
	Date Last Revised: 26 June 2001	
LANL DWG # 135Y299083		Approved By: W. Sondheim
PHENIX DWG #: 002–0312–226		Drawn by: G. Hart
Filename 135Y299083.pcb		Sheet of 5

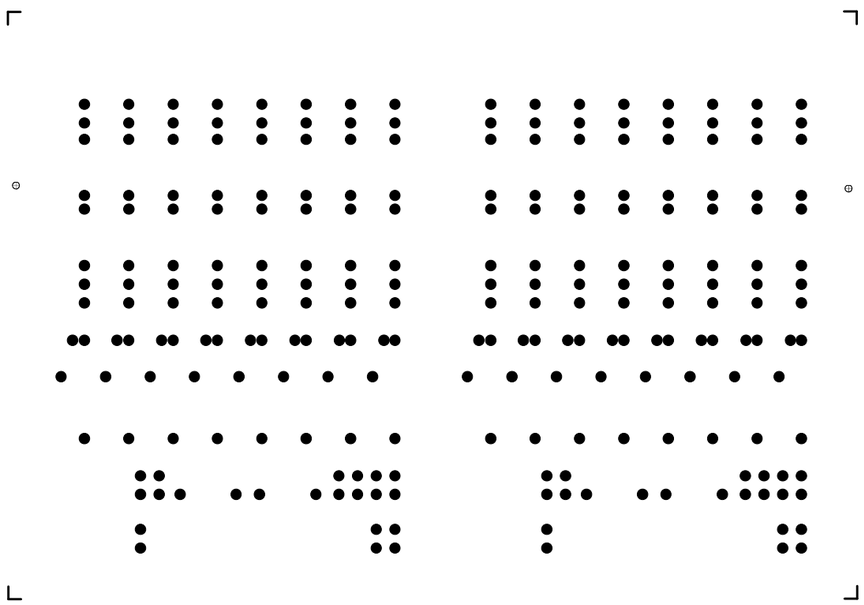
LANL 135Y299083/ PHENIX 002-0312-226

26 June 2001 HV DISTRIBUTION CARD



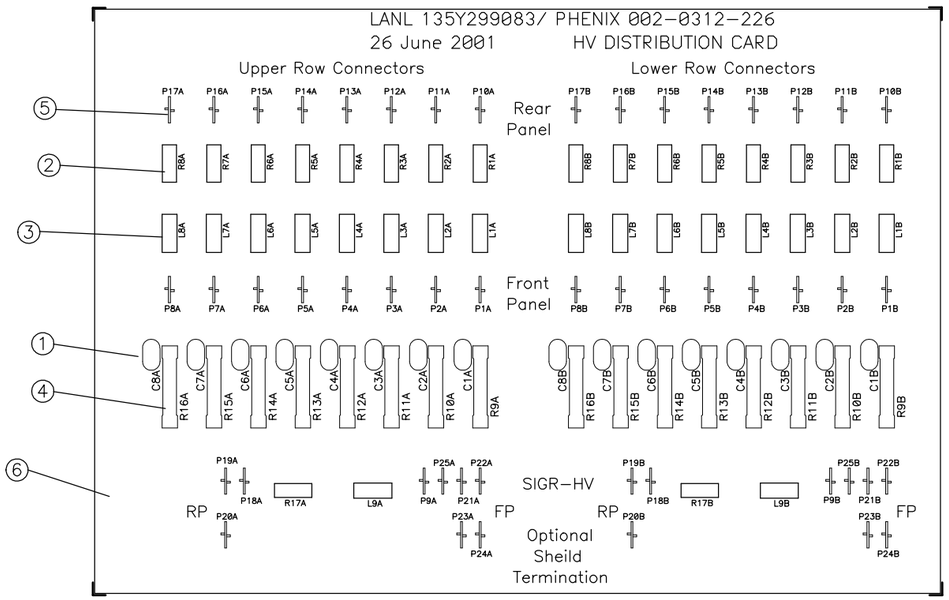
135Y299083 Layer 1 (Top) Silkscreen

26June 2001



135Y299083 Layer 2 (Bottom) Solder Mask
26 June 2001
Red Color

ITEM	QTY	MANUFACTURER	DESCRIPTION	PART #	Source	Cat #	Cost/ea
1	16	Vishay/Sprague	Capacitor, .001 uF @ 3 kV, Ceramic Disk	125LD10	Newark Electronics	46F5219	.43
2	18	SPC/Multicomp	Resistor, 1/2 W, Carbon Comp, 1 K ohm, 5% tol, Pkg 100	RC1/2G102JT	Newark Electronics	10N563	.47
3	18	JW Miller	Inductor, 10 mH, 10 % tol, moulded	9250-106	Newark Electronics	81F3093	6.24
4	16	Ohmite	HV Resistor, 20 G ohm, 20% tol, .35W, 2500 V	MOX-400-22-20,000Meg 20%	Newark Electronics		6.00
5	50	Keystone	Terminal, Vertical, .187 wide, solderless, Male, Pkg 100	1285-ST	Newark Electronics	94F227	3.15
6	1		PC Card	135Y299083	The Circuit Shop		75.00



135Y299083 Layer 1 (Top) Silkscreen
26June 2001

Los Alamos National Laboratory		
Title	HV Board	
North Arm HV Dist. System		
Size C	Date Originated: 23 May 2001	
	Date Last Revised: 26 June 2001	
LANL DWG # 135Y299083		Approved By: W. Sondheim
PHENIX DWG #: 002-0312-226		Drawn by: G. Hart
Filename 135Y299083.pcb		Sheet of 5

Octant 2
GAP 3

Octant 2
GAP 2

Octant 2
GAP 1

Octant 1
GAP 3

Octant 1
GAP 2

Octant 1
GAP 1

Blue Meanies
LHV Plugs

HV Multiconductor
Shielded Cables

to HV Power Supply

Card 6
Section A
(sheet 5)

Card 5
Section A
(sheet 5)

Card 4
Section A
(sheet 5)

Card 3
Section A
(sheet 5)

Card 2
Section A
(sheet 5)

Card 1
Section A
(sheet 5)

8 sockets for 24–20 AWG
2 sockets for 16–18 AWG

11 pins for 24–20 AWG
1 pin for 16–18 AWG

HV Multiconductor
Shielded Cables

11 sockets for 24–20 AWG
9 sockets for 18–16 AWG

17 pins for 24–20 AWG
3 pins for 16–18 AWG

AMP "M" Series HV
Block Connectors

AN 1-1
SIGR-HV
AN 1-2
SIGR-HV
AN 1-3
SIGR-HV
AN 2
SIGR-HV
AN 3
SIGR-HV
AN 4
SIGR-HV
AN 5
SIGR-HV
AN 6
SIGR-HV

24" 16 AWG Leads

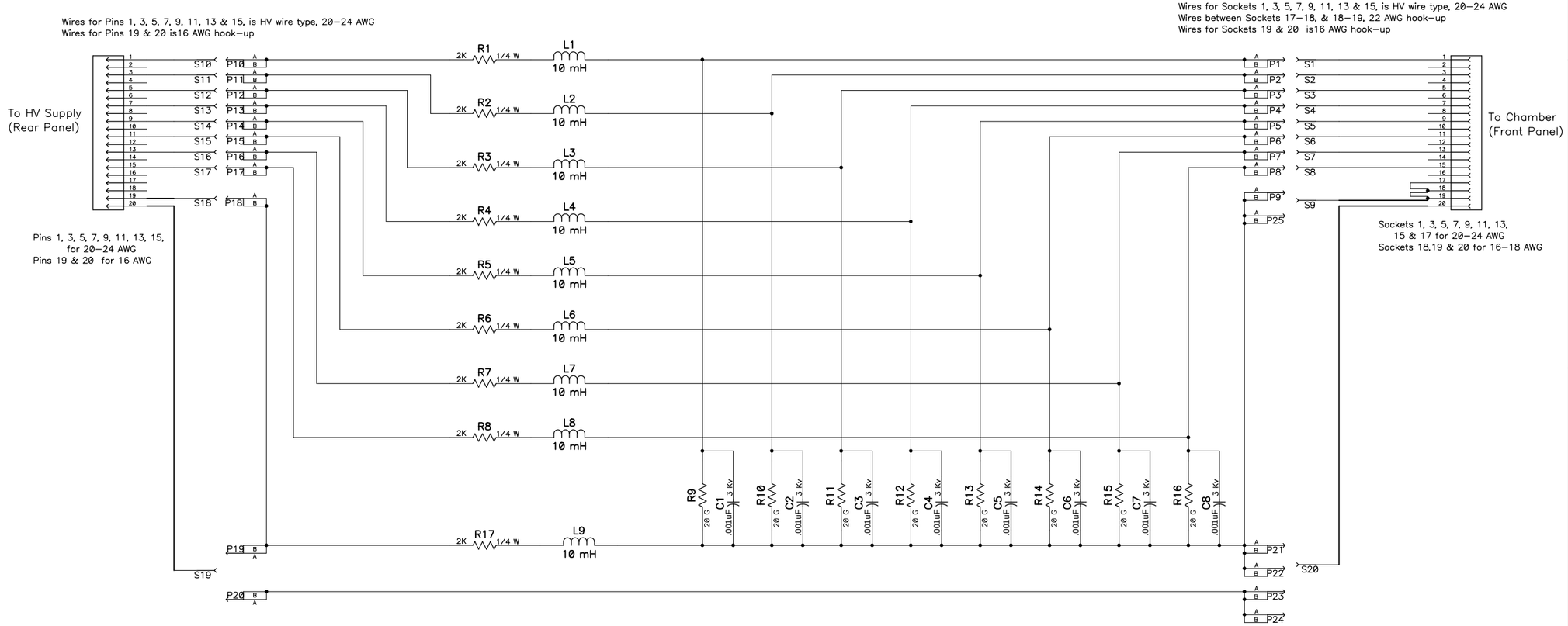
G 1 G 2 G 3
Octant 1

G 1 G 2 G 3
Octant 2

Anode 1
Anode 2
Anode 3
Anode 4
Anode 5
Anode 6

Tw–Pr
__ ft

Los Alamos National Laboratory		
Title: MUON TRACKING HV DIST. SYSTEM		
Station 1 North		
Size	Date Originated: 21 Jan 2000	
	Last Revised: 25 June 2001	
LANL DWG #: St 1 N HV Dist		Approved By:W. Sondheim
PHENIX #: 105–0312–202		Drawn by: G. Hart P–25
Filename: 135Y299083 1 N.sch		Sheet 1 of 5



Typical 8 channels of Distribution / Filter Box

Los Alamos National Laboratory		
Title: MUON TRACKING HV DIST. SYSTEM		
Station 1 North		
Size	Date Originated: 21 Jan 2000	
	Last Revised: 25 June 2001	
LANL DWG #: St 1 N HV Dist		Approved By:W. Sondheim
PHENIX #: 105–0312–202		Drawn by: G. Hart P–25
Filename: 135Y299083 1 N.SCH		Sheet 5 of 5

North Arm HVDS Components

Amp Type M Block Connector

20 HVC Series M Overview
http://catalog.tycoelectronics.com/TE/docs/pdf/1/37/159731.pdf
Type III Pin, 66099
http://catalog.tycoelectronics.com/TE/docs/pdf/9/07/162709.pdf
Type III Socket, 66101
http://catalog.tycoelectronics.com/TE/docs/pdf/1/17/162711.pdf
Type III Pin, 66103
http://catalog.tycoelectronics.com/TE/docs/pdf/3/85/206583.pdf
Type III Socket, 66105
http://catalog.tycoelectronics.com/TE/docs/pdf/4/85/206584.pdf
Type III Contacts, Application Note
http://catalog.tycoelectronics.com/TE/docs/pdf/0/25/158520.pdf
Block connector, 203908
http://catalog.tycoelectronics.com/TE/docs/pdf/4/02/167204.pdf
Block connector, 203909
http://catalog.tycoelectronics.com/TE/docs/pdf/5/02/167205.pdf
Internal Hood, 202434
http://catalog.tycoelectronics.com/TE/docs/pdf/4/71/167174.pdf
Strain Relief, 201224
http://catalog.tycoelectronics.com/TE/docs/pdf/5/80/167085.pdf
Jackscrew, fixed stud kit. 200874
http://catalog.tycoelectronics.com/TE/docs/pdf/5/60/167065.pdf
Jackscrew, female kit, 200867
http://catalog.tycoelectronics.com/TE/docs/pdf/1/60/167061.pdf
Corner guide pin kit, 200833
http://catalog.tycoelectronics.com/TE/docs/pdf/7/41/198147.pdf
Corner guide socket kit, 200835
http://catalog.tycoelectronics.com/TE/docs/pdf/8/41/198148.pdf
Short shield kit, 200517
http://catalog.tycoelectronics.com/TE/docs/pdf/8/11/186118.pdf

LeCroy 9 Pin Plug Connector

Type XI socket, 203802
http://catalog.tycoelectronics.com/TE/docs/pdf/7/89/181987.pdf
Application sheet, Type XI contacts
http://catalog.tycoelectronics.com/TE/docs/pdf/9/15/158519.pdf
Instruction Sheet for type XI hand crimper 90260
http://catalog.tycoelectronics.com/TE/docs/pdf/9/38/206839.pdf

Wire / Cable

Belden, 83026 hook-up wire
http://ecom.belden.com/static/ZZBLDNTD01FROMCATA.HTM?P0=83026
Belden, 83030 hook-up wire
http://ecom.belden.com/static/ZZBLDNTD01FROMCATA.HTM?P0=83030
General Wire Products, 11 cond. HV cable data sheet
Page 63
Judd, 5KV hook-up wire
http://www.juddwire.com/jwelcome.nsf/flexrad_hv.htm

Hardware

Bud cabinet
http://www.budind.com/pdf/hb14097.pdf
SPC / Multicomp, 2642 Card guide
http://www.newark.com/product-details/datasheet/spc/92n4857.pdf
Keystone, Male PC Tab terminals
http://www.newark.com/product-details/text/cd119/9192.html
Voltrex, Solderless push-on crimp terminals
http://www.newark.com/product-details/text/cd119/5503.html

Electronic Components

Sprague, 125LD10 HV Capacitor
http://www.newark.com/product-details/text/cd119/7093.html
SPC / Multicomp½ watt carbon composition resistors
http://www.newark.com/product-details/text/cd119/17346.html
JW Miller, 9250 molded inductor
http://www.newark.com/product-details/text/cd119/7366.html
Ohmite, MOX high value resistor
http://www.ohmite.com/catalog/pdf/v_minimox.pdf
GC 19-155 Silicone
http://www.newark.com/product-details/text/cd119/7522.html

GENERAL WIRE PRODUCTS INC.
425 SHREWBURY STREET
WORCHESTER, MA. USA 01604
TEL # 508-753-2173
FAX # 508-753-2173

SPECIFICATION ON GWP P/N 001-21919 REVISION B

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DESCRIPTION: THE CABLE OUTLINED HERE SHALL MEET OR EXCEED THE PHYSICAL AND ELECTRICAL PERFORMANCE REQUIREMENTS AS OUTLINED IN CEBAF SPECIFICATION 6620-S-01636. ALL MATERIALS AND METHODS USED IN THE MANUFACTURE AND TEST OF THIS PLENUM RATED PRODUCT SHALL COMPLY WITH UL SUBJECTS 13, 910 AND 1581

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GWP P/N	001-21919 REVISION B
CONDUCTOR AWG / STRANDING	#22 19/34 TINNED COPPER
CONDUCTOR DIAMETER	.031”
INSULATION MATERIAL / THICKNESS	TEFZEL / .020”
INSULATION DIAMETER	.071”
TYPE OF COMPONENT	SINGLE CONDUCTOR
NUMBER OF COMPONENTS	11
COLOR CODE	BLK, BRN, RED, ORG, YEL, GRN, BLU, VIO, GRY, WHT, WHT/BLU – BAND MARKED
CABLE FABRICATION	1.6 TWISTS FER FOOT
CABLE DIAMETER	.284”
BINDER	.002” CLEAR MYLAR
FIRST SHIELD	100% FOIL FREE ALUMINIUM FOIL OUT
SECOND SHIELD	90% TINNED COPPER BRAID
DIAMETER OVER SHIELD	.308”
JACKET MATEIAL / THICKNESS	TEFZEL / .015”
COLOR:	RED
FINISHED CABLE DIAMTER	.338”

PRINT: “E102914 CL2P 22 AWG 150 C. (UL)”

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MINIMUM ELECTRICAL REQUIREMENTS

SPARK VOLTAGE INLINE	10 KV DC
HI-POT	10 KV DC
INSULATION RESISTANCE	1,000 VOLTS

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